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## Investigating the paranormal

WE publish this week a paper by Drs R. Targ and H. Puthoff (page 602) which is bound to create something of a stir in the scientific community. The claim is made that information can be transferred by some channel whose characteristics appear to fall "outside the range of known perceptual modalities". Or, more bluntly, some people can read thoughts or see things remotely.

Such a claim is, of course, bound to be greeted with a preconditioned reaction amongst many scientists. To some it simply confirms what they have always known or believed. To others it is beyond the laws of science and therefore necessarily unacceptable. But to a few—though perhaps to more than is realised—the questions are still unanswered, and any evidence of high quality is worth a critical examination.

The issue, then, is whether the evidence is of sufficient quality to be taken seriously. In trying to answer this, we have been fortunate in having the help of three independent referees who have done their utmost to see the paper as a potentially important scientific communication and not as a challenge to or confirmation of prejudices. We thank them for the considerable effort they have put in to helping us, and we also thank Dr Christopher Evans of the National Physical Laboratory whose continued advice on the subject is reflected in the content of this leading article.

A general indication of the referees' comments may be helpful to readers in reaching their own assessment of the paper. Of the three, one believed we should not publish, one did not feel strongly either way and the third was guardedly in favour of publication. We first summarise the arguments against the paper.

(1) There was agreement that the paper was weak in design and presentation, to the extent that details given as to the precise way in which the experiment was carried out were disconcertingly vague. The referees felt that insufficient account had been taken of the established methodology of experimental psychology and that in the form originally submitted the paper would be unlikely to be accepted for publication in a psychological journal on these grounds alone. Two referees also felt that the authors had not taken into account the lessons learnt in the past by parapsychologists researching this tricky and complicated area.

(2) The three referees were particularly critical of the method of target selection used, pointing out that the choice of a target by "opening a dictionary at random" is a naive, vague and unnecessarily controversial approach to randomisation. Parapsychologists have long rejected such methods of target selection and, as one referee put it, weaknesses of this kind reveal "a lack of skill in their experiments, which might have caused them to make some other mistake which is less evident from their writing".

(3) All the referees felt that the details given of various safeguards and precautions introduced against the possibility of unconscious fraud on the part of one or other of the subjects were "uncomfortably vague"

(to use one phrase). This in itself might be sufficient to raise doubt that the experiments have demonstrated the existence of a new channel of communication which does not involve the use of the senses.

(4) Two of the referees felt that it was a pity that the paper, instead of concentrating in detail and with meticulous care on one particular approach to extra-sensory phenomena, produced a mixture of different experiments, using different subjects in unconnected circumstances and with only a tenuous overall theme. At the best these were more "a series of pilot studies . . . than a report of a completed experiment".

On their own these highly critical comments could be grounds for rejection of the paper, but it was felt that other points needed to be taken into account before a final decision could be made.

(1) Despite its shortcomings, the paper is presented as a scientific document by two qualified scientists, writing from a major research establishment apparently with the unqualified backing of the research institute itself.

(2) The authors have clearly attempted to investigate under laboratory conditions phenomena which, while highly implausible to many scientists, would nevertheless seem to be worthy of investigation even if, in the final analysis, negative findings are revealed. If scientists dispute and debate the reality of extra-sensory perception, then the subject is clearly a matter for scientific study and reportage.

(3) Very considerable advance publicity—it is fair to say not generated by the authors or their institute—has preceded the presentation of this report. As a result many scientists and very large numbers of non-scientists believe, as the result of anecdote and hearsay, that the Stanford Research Institute (SRI) was engaged in a major research programme into parapsychological matters and had even been the scene of a remarkable breakthrough in this field. The publication of this paper, with its muted claims, suggestions of a limited research programme, and modest data, is, we believe, likely to put the whole matter in more reasonable perspective.

(4) The claims that have been made by, or on behalf of, one of the subjects, Mr Uri Geller, have been hailed publicly as indicating total acceptance by the SRI of allegedly sensational powers and may also perhaps now be seen in true perspective. It must be a matter of interest to scientists to note that, contrary to very widespread rumour, the paper does not present any evidence whatsoever for Geller's alleged abilities to bend metal rods by stroking them, influence magnets at a distance, make watches stop or start by some psychokinetic force and so on. The publication of the paper would be justified on the grounds of allowing scientists the opportunity to discriminate between the cautious, limited and still highly debatable experimental data, and extravagant rumour, fed in recent days by inaccurate attempts in some newspapers at precognition of the contents of the paper.

(5) Two of the referees also felt that the paper should be published because it would allow parapsychologists, and all other scientists interested in researching this arguable field, to gauge the quality of the Stanford research and assess how much it has to offer to the study of psychology.

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(\*) *Nature*, although seen by some as one of the world's most respected journals cannot afford to live on respectability. We believe that our readers expect us to be a home for the occasional 'high-risk' type of paper. This is hardly to assert that we regularly fly in the face of referees' recommendations (we always consider the possibility of publishing, as in this case, a summary of their objections). It is to say that the unusual must now and then be allowed a toe-hold in the literature, sometimes to flourish, more often to be forgotten within a year or two.

The critical comments above were sent to the authors who have modified their manuscript in response to them. We have also corresponded informally with the authors on one or two issues such as whether the targets could have been forced by standard magical tricks, and are convinced that this is not the case. As a result of these exchanges and the above considerations we have decided to publish in the belief that, however flawed the experimental procedure and however difficult the process of distilling the essence of a complex series of events into a scientific manuscript, it was on balance preferable to publish and maybe stimulate and advance the controversy rather than keep it out of circulation for a further period.

Publishing in a scientific journal is not a process of receiving a seal of approval from the establishment; rather it is the serving of notice on the community that there is something worthy of their attention and scrutiny. And this

scrutiny is bound to increase amongst some to repeat the experiments with even more caution. To this end the *New Scientist* does a service by publishing this week the results of Dr Joe Hanlon's own investigations into a wide range of phenomena surrounding Mr Geller. If the subject is to be investigated further—and no scientist is likely to accept more than that the SRI experiments provide a *prima facie* case for more investigations—the experimental technique will have to take account of Dr Hanlon's strictures, those of our own referees and those, doubtless, of others who will be looking for alternative explanations.

Perhaps the most important issue raised by the circumstances surrounding the publication of this paper is whether science has yet developed the competence to confront claims of the paranormal. Supposedly paranormal events frequently cannot be investigated in the calm, controlled and meticulous way that scientists are expected to work, and so there is always a danger that the investigator, swept up in the confusion that surrounds many experiments, abandons his initial intentions in order to go along with his subject's desires. It may be that all experiments of this sort should be exactly prescribed beforehand by one group, done by another unassociated group and evaluated in terms of performance by the first group. Only by increasing austerity of approach by scientists will there be any major progress in this field.

## For those in peril on the factory floor

*In this article Peter J. Smith argues that a greater commitment (in deed as well as word) to community science by the Scientific Establishment might help the world of science regain some of the public respect it has lost.*

THE question of who speaks, or should speak, on behalf of the scientific community has been debated on many occasions, most often without result. On the face of it, such lack of resolution is hardly unexpected, for scientists and scientific institutions are not noted for their ready ability to achieve consensus. Yet there is no doubt that they can put up a pretty collective front when they feel so moved. The one famous occasion on which a near consensus was reached was when the scientific community saw itself put at risk financially by the Rothschild proposals. Then individuals and institutions miraculously found a common cause of self-preservation.

But when it comes to the defence of less privileged groups it is quite a different story; the voice of the British scientific community is seldom to be heard, whether taking a moral stance, exerting humanitarian pressure, supplying expertise or even simply providing information. A good case in point is provided by a new *Socialist Worker* pamphlet entitled *Asbestos: The Dust that Kills in the Name of Profit*. As

the title hints, the object of *Socialist Worker* is nothing less than the complete overthrow of the capitalist system; and one of the ways of achieving this aim, it seems, is to give strident publicity to defects in the capitalist-industrial system. Fortunately, one can easily avoid a sharp turn to the left and still admit that what some British workers have been subjected to in the name of asbestos production is beyond the limit of acceptability in a humanitarian society.

For what clearly emerges from the rhetoric of the pamphlet in question is a picture of men and women reacting in some bewilderment to the long-term ill effects of a technological activity. The chief consequence is, of course, asbestosis—a killing disease acquired by breathing in asbestos fibres. The bulk of the pamphlet is devoted to case histories of men to whom asbestosis has come as a shock after a decade or so in the industry. But more instructively, there is also a short account of the fight for safety put up by a small group of the 7/162 Glasgow insulation workers' branch of the Transport and General Workers Union against the obstruction of the asbestos companies, the indifference of politicians, the weakness of the Factory Inspectorate, the silence of much of the press, the impotence of health authorities, the equivocal official stance of unions in general, and last but not least, apathy among many workers

asbestos workers themselves.

And there is certainly something to fight about. According to Patrick Kinnersly (*The Hazards of Work: How to Fight Them*, Pluto Press, 1973), asbestosis is taking an increasing toll: 64 are known to have died in 1965, 107 in 1970 and 113 in 1971. The number of new cases diagnosed rose from 82 in 1965 to 153 in 1970. Moreover, asbestosis is only one of the asbestos-induced diseases. Lung cancer appears to require a smaller exposure to asbestos. There is also another form of cancer known as mesothelioma which involves growths in the linings of the lungs and stomach. Almost all mesotheliomas are caused by asbestos; but no one knows how many workers in Britain are killed by them, partly because they take so long to develop and partly because they are not always identified. The TUC Centenary Institute of Occupational Health has suggested that, 30 years after first exposure, about one in 200 will be found to have died of mesothelioma; but Dr Irving J. Selikoff of Mount Sinai Hospital in New York is apparently more pessimistic. He has recently been quoted as saying that, for every 100,000 workers entering the asbestos industry under the safety standards obtaining in the United States as recently as 1971, he would expect 20,000 to die of lung cancer, 7,000 of mesothelioma and 7,000 of asbestosis.

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Legon poses, as a challenge, the problem of obtaining work from the mixing of two ideal gases in an isolated system of constant total volume. It is elementary that if the mixture is allowed to form by merely withdrawing a partition between the gases we have a good example of a completely irreversible process with maximal entropy creation ( $+11.53 \text{ J K}^{-1}$  if we started with 1 mol of each at 300 K) and no performance or storage of work. On the other hand, by introducing into the system a suitable machine, the uniform mixture could be allowed to form in such a way that a weight within the system was raised. (The machine described by Planck (ref. 8, page 219) may be readily adapted for this purpose.) At the end of the latter mixing process the isolated system would accordingly contain more mechanical energy than it did at the beginning. From the First Law it follows that the system must necessarily contain less thermal energy; that is, its temperature must have fallen. In the limit, where the mixing was reversible, the maximum possible work would have been performed and transferred to the weight (2,769 J if the gases were monatomic) and the temperature would have fallen to 189 K. In this reversible case the change in entropy arising from mixing ( $+11.53 \text{ J K}^{-1}$ ) is exactly counterbalanced by that attributable to cooling ( $-11.53 \text{ J K}^{-1}$ ): no entropy is created.

At this point it might be objected that the change in the gases is not exactly the same as if they had mixed irreversibly, because their thermal energy and temperature have decreased. This is a simple consequence of the First Law which applies equally no matter whether one is considering an isolated system, a non-isolated one or the whole Universe. If a change is conducted in such a way that a weight is lifted then all the other bodies involved cannot possibly end up in the same state as if the weight had not been lifted.

**Failure to apply to nonisothermal systems.** Legon expresses doubts about the validity of the equation for entropy creation (refs 3 and 4) save for "the trivial case for which the temperature  $T_e$  of the environment is equal to the temperature  $T$  of the system throughout the process". On what grounds are these doubts based? Legon does not discuss, let alone dismiss, any of the sources quoted in my article<sup>5</sup>. Other relevant sources which should be considered are Keenan and Hatsopoulos<sup>13</sup> and the classic accounts by Maxwell<sup>10</sup> and by Gouy<sup>14</sup>.

Legon's quotation from Planck (ref. 8, page 104) concerning "dissipated energy" deserves close consideration. It seems to state that the maximum work is a definite quantity only for isothermal processes. If true this would directly contradict the views of Thomson<sup>15</sup> (later Lord Kelvin) "On a universal tendency in Nature to the dissipation of mechanical energy". On pages 113-117 of ref. 8, however, Planck discusses his own statement (ref. 8, page 104) and we see that there is in fact no contradiction. What Planck demonstrates is that although the change in Helmholtz free energy,  $-dA = -d(U - TS)$ , measures  $w_{\max}$  under isothermal conditions, it cannot conveniently be used to determine  $w_{\max}$  under nonisothermal conditions because the term  $S dT$  that then appears is frequently indeterminate. The same point has already been made in a footnote by Gouy (ref. 15, page 506) who had also given the correct equation for determining  $w_{\max}$  under nonisothermal conditions. Accordingly I find no substance in Legon's objections under this heading.

If it is thought that there is conflict between the 'work' view of thermodynamics and the 'entropy' view it is high time that the idea was abandoned. The two views are different, but symmetrical, aspects of the same reality. Spontaneous processes of all kinds fall somewhere within the pattern shown in Table 1, their position depending on the efficiency of the machinery used for the extraction of work.

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## Information transmission under conditions of sensory shielding

We present results of experiments suggesting the existence of one or more perceptual modalities through which individuals obtain information about their environment, although this information is not presented to any known sense. The literature<sup>1-3</sup> and our observations lead us to conclude that such abilities can be studied under laboratory conditions.

We have investigated the ability of certain people to describe graphical material or remote scenes shielded against ordinary perception. In addition, we performed pilot studies to determine if electroencephalographic (EEG) recordings might indicate perception of remote happenings even in the absence of correct overt responses.

We concentrated on what we consider to be our primary responsibility—to resolve under conditions as unambiguous as possible the basic issue of whether a certain class of para-normal perception phenomena exists. So we conducted our experiments with sufficient control, utilising visual, acoustic and electrical shielding, to ensure that all conventional paths of sensory input were blocked. At all times we took measures to prevent sensory leakage and to prevent deception, whether intentional or unintentional.

Our goal is not just to catalogue interesting events, but to uncover patterns of cause-effect relationships that lend themselves to analysis and hypothesis in the forms with which we are familiar in scientific study. The results presented here constitute a first step towards that goal; we have established under known conditions a data base from which departures as a function of physical and psychological variables can be studied in future work.

### REMOTE PERCEPTION OF GRAPHIC MATERIAL

First, we conducted experiments with Mr Uri Geller in which we examined his ability, while located in an electrically shielded room, to reproduce target pictures drawn by experimenters located at remote locations. Second, we conducted double-blind experiments with Mr Pat Price, in which we measured his ability to describe remote outdoor scenes many miles away. In a third series of experiments we conducted pre-

liminary tests using EEG in which subjects were asked to perceive whether a remote light was flashing, and to determine whether a subject could perceive the presence of the light, even if only at a nonecognitive level of awareness.

In preliminary testing Geller apparently demonstrated an ability to reproduce simple pictures (line drawings) which had been drawn and placed in opaque sealed envelopes which he was not permitted to handle. But since each of the targets was known to at least one experimenter in the room with Geller, it was not possible on the basis of the preliminary testing to discriminate between Geller's direct perception of envelope contents and perception through some mechanism involving the experimenters, whether paranormal or subliminal.

So we examined the phenomenon under conditions designed to eliminate all conventional information channels, overt or subliminal. Geller was separated from both the target material and anyone knowledgeable of the material, as in the experiments of ref. 4.

In the first part of the study a series of 13 separate drawing experiments were carried out over 7 days. No experiments are deleted from the results presented here.

At the beginning of the experiment either Geller or the experimenters entered a shielded room so that from that time forward Geller was at all times visually, acoustically and electrically shielded from personnel and material at the target location. Only following Geller's isolation from the experimenters was a target chosen and drawn, a procedure designed to eliminate pre-experiment cuing. Furthermore, to eliminate the possibility of pre-experiment target forcing, Geller was kept ignorant as to the identity of the person selecting the target and as to the method of target selection. This was accomplished by the use of three different techniques: (1) pseudo-random technique of opening a dictionary arbitrarily and choosing the first word that could be drawn (Experiments 1-4); (2) targets, blind to experimenters and subject, prepared independently by

SRI scientists outside the experimental group (following Geller's isolation) and provided to the experimenters during the course of the experiment (Experiments 5-7, 11-13); and (3) arbitrary selection from a target pool decided upon in advance of daily experimentation and designed to provide data concerning information content for use in testing specific hypotheses (Experiments 8-10). Geller's task was to reproduce with pen on paper the line drawing generated at the target location. Following a period of effort ranging from a few minutes to half an hour, Geller either passed (when he did not feel confident) or indicated he was ready to submit a drawing to the experimenters, in which case the drawing was collected before Geller was permitted to see the target.

To prevent sensory cueing of the target information, Experiments 1 through 10 were carried out using a shielded room in SRI's facility for EEG research. The acoustic and visual isolation is provided by a double-walled steel room, locked by means of an inner and outer door, each of which is secured with a refrigerator-type locking mechanism. Following target selection when Geller was inside the room, a one-way audio monitor, operating only from the inside to the outside, was activated to monitor Geller during his efforts. The target picture was never discussed by the experimenters after the picture was drawn and brought near the shielded room. In our detailed examination of the shielded room and the protocol used in these experiments, no sensory leakage has been found.

The conditions and results for the 10 experiments carried out in the shielded room are displayed in Table 1 and Fig. 1. All experiments except 4 and 5, were conducted with Geller inside the shielded room. In Experiments 4 and 5, the procedure was reversed. For those experiments in which Geller was inside the shielded room, the target location was in an adjacent room at a distance of about 4 m, except for Experiments 3 and 8, in which the target locations were, respectively, an office at a distance of 475 m and a room at a distance of about 7 m.

A response was obtained in all experiments except Numbers 5-7. In Experiment 5, the person-to-person link was eliminated by arranging for a scientist outside the usual experimental group to draw a picture, lock it in the shielded room before Geller's arrival at SRI, and leave the area. Geller was then led

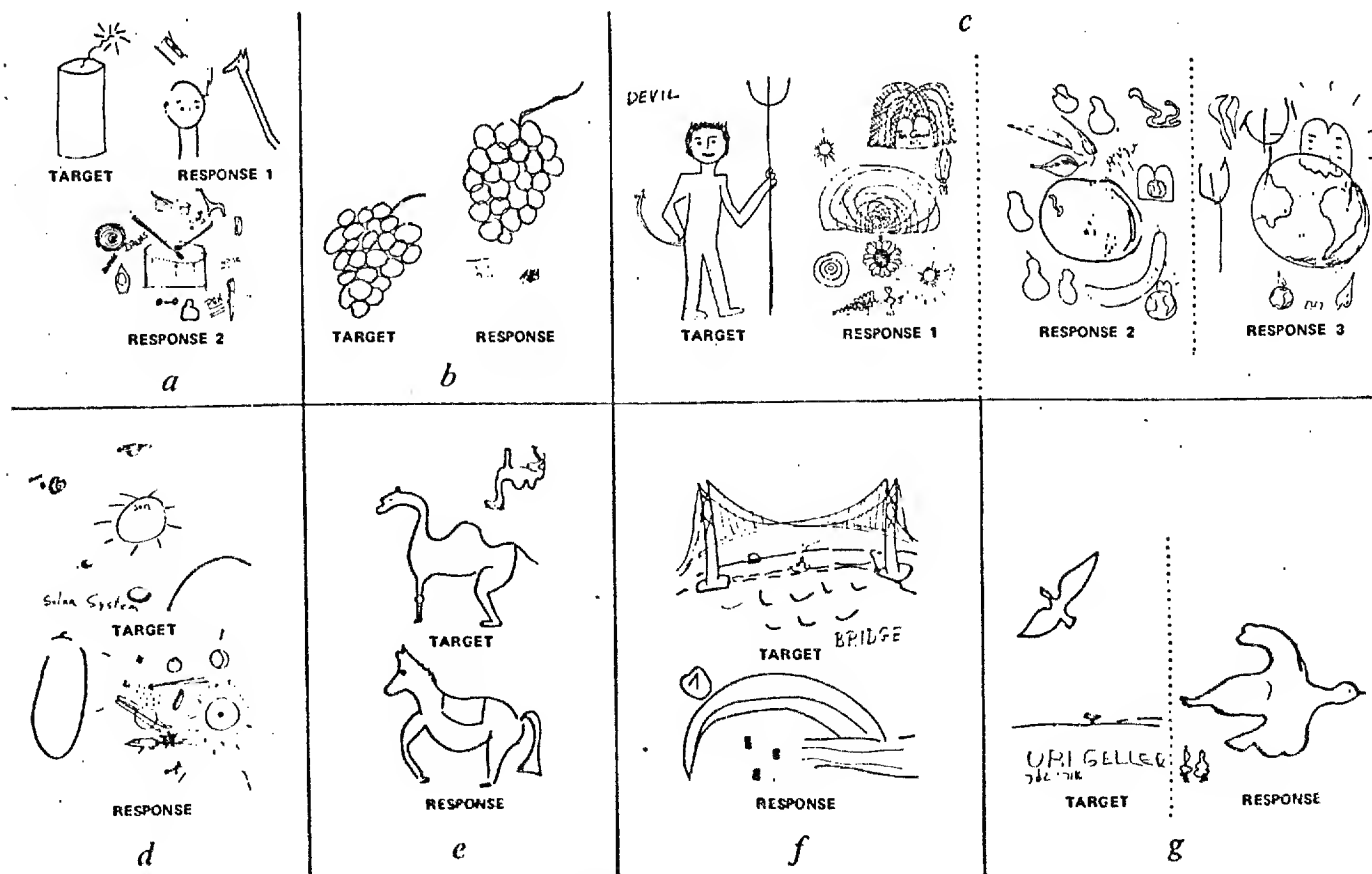


Fig. 1. Target pictures and responses drawn by Uri Geller under shielded conditions.

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Table 1 Remote perception of graphic material

Experiment	Date (month, day, year)	Geller Location	Target Location	Target	Figure
1	8/4/73	Shielded room 1*	Adjacent room (4.1 m)†	Firecracker	1a
2	8/4/73	Shielded room 1	Adjacent room (4.1 m)	Grapes	1b
3	8/5/73	Shielded room 1	Office (475 m)	Devil	1c
4	8/5/73	Room adjacent to shielded room 1	Shielded room 1 (3.2 m)	Solar system	1d
5	8/6/73	Room adjacent to shielded room 1	Shielded room 1 (3.2 m)	Rabbit	No drawing
6	8/7/73	Shielded room 1	Adjacent room (4.1 m)	Tree	No drawing
7	8/7/73	Shielded room 1	Adjacent room (4.1 m)	Envelope	No drawing
8	8/8/73	Shielded room 1	Remote room (6.75 m)	Camel	1e
9	8/8/73	Shielded room 1	Adjacent room (4.1 m)	Bridge	1f
10	8/8/73	Shielded room 1	Adjacent room (4.1 m)	Seagull	1g
11	8/9/73	Shielded room 2‡	Computer (54 m)	Kite (computer CRT)	2a
12	8/10/73	Shielded room 2	Computer (54 m)	Church (computer memory)	2b
13	8/10/73	Shielded room 2	Computer (54 m)	Arrow through heart (computer CRT, zero intensity)	2c

\*EEG Facility shielded room (see text).

†Perceiver-target distances measured in metres.

‡SRI Radio Systems Laboratory shielded room (see text).

by the experimenters to the shielded room and asked to draw the picture located inside the room. He said that he got no clear impression and therefore did not submit a drawing. The elimination of the person-to-person link was examined further in the second series of experiments with this subject.

Experiments 6 and 7 were carried out while we attempted to record Geller's EEG during his efforts to perceive the target pictures. The target pictures were, respectively, a tree and an envelope. He found it difficult to hold adequately still for good EEG records, said that he experienced difficulty in getting impressions of the targets and again submitted no drawings.

Experiments 11 through 13 were carried out in SRI's Engineering Building, to make use of the computer facilities available there. For these experimenters, Geller was sequestered in a double-walled, copper-screen Faraday cage 54 m down the hall and around the corner from the computer room. The Faraday cage provides 120 dB attenuation for plane wave radio frequency radiation over a range of 15 kHz to 1 GHz. For magnetic fields the attenuation is 68 dB at 15 kHz and decreases to 3 dB at 60 Hz. Following Geller's isolation, the targets for these experiments were chosen by computer laboratory personnel not otherwise associated with either the experiment or Geller, and the experimenters and subject were kept blind as to the contents of the target pool.

For Experiment 11, a picture of a kite was drawn on the face of a cathode ray tube display screen, driven by the computer's graphics program. For Experiment 12, a picture of a church was drawn and stored in the memory of the computer. In Experiment 13, the target drawing, an arrow through a heart (Fig. 2g), was drawn on the face of the cathode ray tube and then the display intensity was turned off so that no picture was visible.

To obtain an independent evaluation of the correlation between target and response data, the experimenters submitted the data for judging on a 'blind' basis by two SRI scientists who were not otherwise associated with the research. For the 10 cases in which Geller provided a response, the judges were asked to match the response data with the corresponding target data (without replacement). In those cases in which Geller made more than one drawing as his response to the target, all the drawings were combined as a set for judging. The two judges each matched the target data to the response data with no error. For either judge such a correspondence has an *a priori* probability, under the null hypothesis of no information channel, of  $P = (10!)^{-1} = 3 \times 10^{-7}$ .

A second series of experiments was carried out to determine whether direct perception of envelope contents was possible without some person knowing of the target picture.

One hundred target pictures of everyday objects were drawn by an

envelopes containing black cardboard. The hundred targets were divided randomly into groups of 20 for use in each of the three days' experiments.

On each of the three days of these experiments, Geller passed. That is, he declined to associate any envelope with a drawing that he made, expressing dissatisfaction with the existence of such a large target pool. On each day he made approximately 12 recognisable drawings, which he felt were associated with the entire target pool of 100. On each of the three days, two of his drawings could reasonably be associated with two of the 20 daily targets. On the third day, two of his drawings were very close replications of two of that day's target pictures. The drawings resulting from this experiment do not depart significantly from what would be expected by chance.

In a simpler experiment Geller was successful in obtaining information under conditions in which no persons were knowledgeable of the target. A double-blind experiment was performed in which a single 3/4 inch die was placed in a 3 × 4 × 5 inch steel box. The box was then vigorously shaken by one of the experimenters and placed on the table, a technique found in control runs to produce a distribution of die faces differing non-significantly from chance. The orientation of the die within the box was unknown to the experimenters at that time. Geller would then write down which die face was uppermost. The target pool was known, but the targets were individually prepared in a manner blind to all persons involved in the experiment. This experiment was performed ten times, with Geller passing twice and giving a response eight times. In the eight times in which he gave a response, he was correct each time. The distribution of responses consisted of three 2s, one 4, two 5s, and two 6s. The probability of this occurring by chance is approximately one in 10<sup>6</sup>.

In certain situations significant information transmission can take place under shielded conditions. Factors which appear to be important and therefore candidates for future investigation include whether the subject knows the set of targets in the target pool, the actual number of targets in the target pool at any given time, and whether the target is known by any of the experimenters.

It has been widely reported that Geller has demonstrated the ability to bend metal by paranormal means. Although metal bending by Geller has been observed in our laboratory, we have not been able to combine such observations with adequately controlled experiments to obtain data sufficient to support the paranormal hypothesis.

#### REMOTE VIEWING OF NATURAL TARGETS

A study by Osiris<sup>6</sup> led us to determine whether a subject could describe randomly chosen geographical sites located several

miles from the subject's position and demarcated by some

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appropriate means (remote viewing). This experiment carried out with Price, a former California police commissioner and city councilman, consisted of a series of double-blind, demonstration-of-ability tests involving local targets in the San Francisco Bay area which could be documented by several independent judges. We planned the experiment considering that natural geographical places or man-made sites that have existed for a long time are more potent targets for paranormal perception experiments than are artificial targets prepared in the laboratory. This is based on subject opinions that the use of artificial targets involves a 'trivialisation of the ability' as compared with natural pre-existing targets.

In each of nine experiments involving Price as subject and SRI experimenters as a target demarcation team, a remote location was chosen in a double-blind protocol. Price, who remained at SRI, was asked to describe this remote location, as well as whatever activities might be going on there.

Several descriptions yielded significantly correct data pertaining to and descriptive of the target location.

In the experiments a set of twelve target locations clearly differentiated from each other and within 30 min driving time from SRI had been chosen from a target-rich environment (more than 100 targets of the type used in the experimental series) prior to the experimental series by an individual in SRI management, the director of the Information Science and Engineering Division, not otherwise associated with the experiment. Both

the experimenters and the subject were kept blind as to the contents of the target pool, which were used without replacement.

An experimenter was closeted with Price at SRI to wait 30 min to begin the narrative description of the remote location. The SRI locations from which the subject viewed the remote locations consisted of an outdoor park (Experiments 1, 2), the double-walled copper-screen Faraday cage discussed earlier (Experiments 3, 4, and 6-9), and an office (Experiment 5). A second experimenter would then obtain a target location from the Division Director from a set of travelling orders previously prepared and randomised by the Director and kept under his control. The target demarcation team (two to four SRI experimenters) then proceeded directly to the target by automobile without communicating with the subject or experimenter remaining behind. Since the experimenter remaining with the subject at SRI was in ignorance both as to the particular target and as to the target pool, he was free to question Price to clarify his descriptions. The demarcation team then remained at the target site for 30 min after the 30 min allotted for travel. During the observation period, the remote-viewing subject would describe his impressions of the target site into a tape recorder. A comparison was then made when the demarcation team returned.

Price's ability to describe correctly buildings, docks, roads, gardens and so on, including structural materials, colour, ambience and activity, sometimes in great detail, indicated the functioning of a remote perceptual ability. But the descriptions contained inaccuracies as well as correct statements. To obtain a numerical evaluation of the accuracy of the remote viewing experiment, the experimental results were subjected to independent judging on a blind basis by five SRI scientists who were

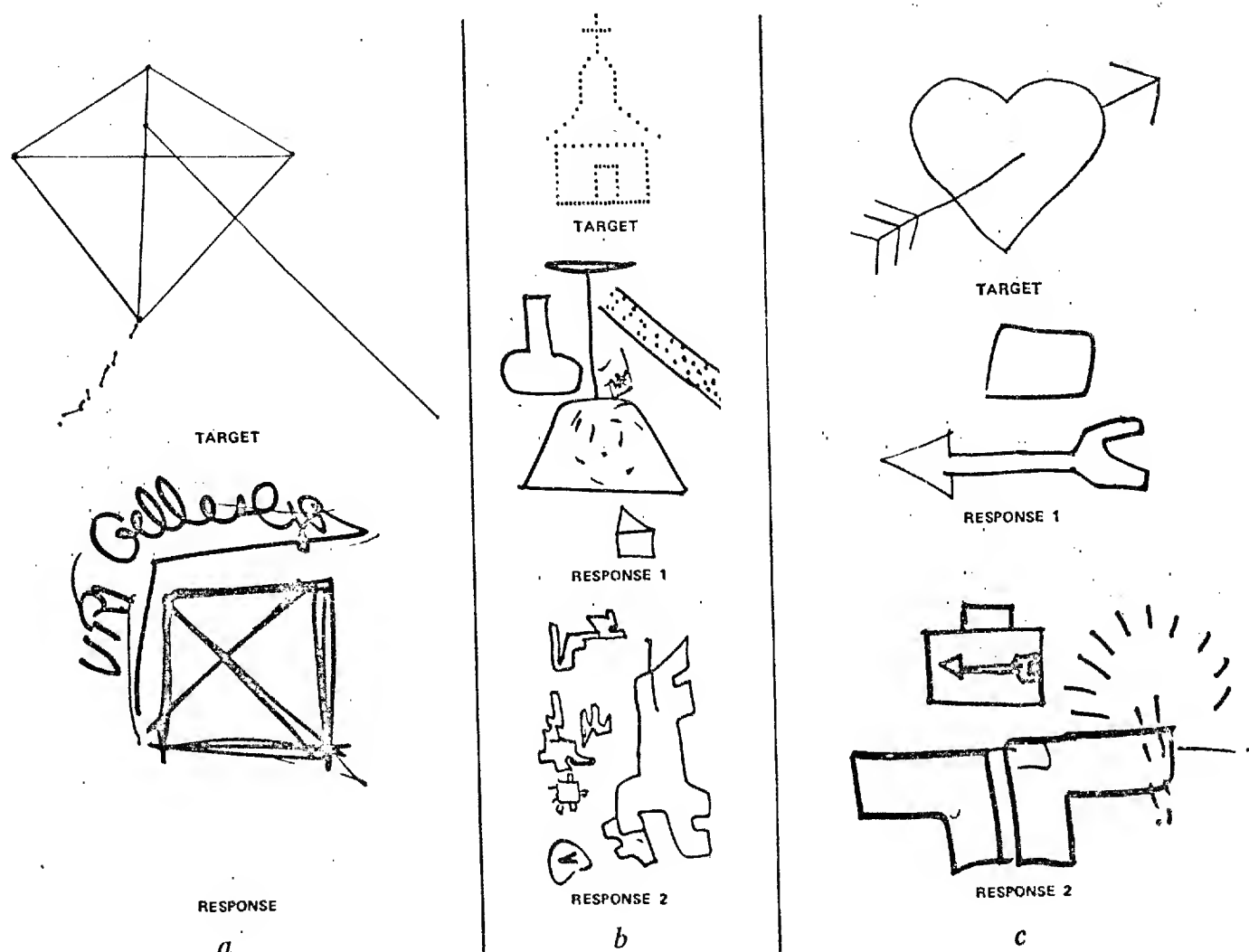


Fig. 1. a, Target and responses drawn by Uri Geller. b, Computer drawing stored on video display; c, computer drawing stored in computer memory only. d, Computer drawing stored on video display.

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Table 2 Distribution of correct selections by judges A, B, C, D, and E in remote viewing experiments

Descriptions chosen by judges	Places visited by judges								
	1	2	3	4	5	6	7	8	9
Hoover Tower	1	ABCDE							
Baylands Nature Preserve	2		ABC				D		D
Radio Telescope	3			E					
Redwood City Marina	4		CD	ABDE					
Bridge Toll Plaza	5				BE				
Drive-In Theatre	6		B		A	ABD		DCE	E
Arts and Crafts Garden Plaza	7					C	ABCE		
Church	8							AB	
Rinconada Park	9		CE						AB

Of the 45 selections (5 judges, 9 choices), 24 were correct. Bold type indicates the description chosen most often for each place visited. Correct choices lie on the main diagonal. The number of correct matches by Judges A through E is 7, 6, 5, 3, and 3, respectively. The expected number of correct matches from the five judges was five; in the experiment 24 such matches were obtained. The *a priori* probability of such an occurrence by chance, conservatively assuming assignment without replacement on the part of the judges, is  $P = 8.10^{-10}$ .

not otherwise associated with the research. The judges were asked to match the nine locations, which they independently visited, against the typed manuscripts of the tape-recorded narratives of the remote viewer. The transcripts were unlabelled and presented in random order. The judges were asked to find a narrative which they would consider the best match for each of the places they visited. A given narrative could be assigned to more than one target location. A correct match requires that the transcript of a given date be associated with the target of that date. Table 2 shows the distribution of the judges' choices.

Among all possible analyses, the most conservative is a permutation analysis of the plurality vote of the judges' selections assuming assignment without replacement, an approach independent of the number of judges. By plurality vote, six of the nine descriptions and locations were correctly matched. Under the null hypothesis (no remote viewing and a random selection of descriptions without replacement), this outcome has an *a priori* probability of  $P = 5.6 \times 10^{-4}$ , since, among all possible permutations of the integers one through nine, the probability of six or more being in their natural position in the list has that value. Therefore, although Price's descriptions contain inaccuracies, the descriptions are sufficiently accurate to permit the judges to differentiate among the various targets to the degree indicated.

### EEG EXPERIMENTS

An experiment was undertaken to determine whether a physiological measure such as EEG activity could be used as an indicator of information transmission between an isolated subject and a remote stimulus. We hypothesised that perception could be indicated by such a measure even in the absence of verbal or other overt indicators.<sup>6,7</sup>

It was assumed that the application of remote stimuli would result in responses similar to those obtained under conditions of direct stimulation. For example, when normal subjects are stimulated with a flashing light, their EEG typically shows a decrease in the amplitude of the resting rhythm and a driving of the brain waves at the frequency of the flashes<sup>8</sup>. We hypothesised that if we stimulated one subject in this manner (a sender), the EEG of another subject in a remote room with no flash present (a receiver), might show changes in alpha (9–11 Hz) activity, and possibly EEG driving similar to that of the sender.

We informed our subject that at certain times a light was to be flashed in a sender's eyes in a distant room, and if the subject perceived that event, consciously or unconsciously, it might be evident from changes in his EEG output. The receiver was seated in the visually opaque, acoustically and electrically shielded double-walled steel room previously described. The sender was seated in a room about 7 m from the receiver.

To find subjects who were responsive to such a remote stimulus, we initially worked with four female and two male volunteer subjects, all of whom believed that success in the experiment was a possibility. Each subject was given 12 trials

'receivers'. The senders were either other subjects or the experimenters. We decided beforehand to run one or two sessions of 36 trials each with each subject in this selection procedure, and to do a more extensive study with any subject whose results were positive.

A Grass PS-2 photostimulator placed about 1 m in front of the sender was used to present flash trains of 10 s duration. The receiver's EEG activity from the occipital region (Oz), referenced to linked mastoids, was amplified with a Grass 5P-1 preamplifier and associated driver amplifier with a bandpass of 1–120 Hz. The EEG data were recorded on magnetic tape with an Ampex SP 300 recorder.

On each trial, a tone burst of fixed frequency was presented to both sender and receiver and was followed in one second by either a 10 s train of flashes or a null flash interval presented to the sender. Thirty-six such trials were given in an experimental session, consisting of 12 null trials—no flashes following the tone—12 trials of flashes at 6 f.p.s. and 12 trials of flashes at 16 f.p.s., all randomly intermixed, determined by entries from a table of random numbers. Each of the trials generated an 11-s EEG epoch. The last 4 s of the epoch was selected for analysis to minimise the desynchronising action of the warning cue. This 4-s segment was subjected to Fourier analysis on a LINC 8 computer.

Spectrum analyses gave no evidence of EEG driving in any receiver, although in control runs the receivers did exhibit driving when physically stimulated with the flashes. But of the six subjects studied initially, one subject (H. H.) showed a consistent alpha blocking effect. We therefore undertook further study with this subject.

Data from seven sets of 36 trials each were collected from this subject on three separate days. This comprises all the data collected to date with this subject under the test conditions described above. The alpha band was identified from average spectra, then scores of average power and peak power were obtained from individual trials and subjected to statistical analysis.

Of our six subjects, H. H. had by far the most monochromatic EEG spectrum. Figure 3 shows an overlay of the three averaged spectra from one of this subject's 36-trial runs, displaying changes in her alpha activity for the three stimulus conditions.

Mean values for the average power and peak power for each

Table 3 EEG data for H.H. showing average power and peak power in the 9–11 Hz band, as a function of flash frequency and sender

Flash Frequency	0	6	16	0	6	16
Sender	Average Power			Peak Power		
J.L.	94.8	84.1	76.8	357.7	329.2	289.6
R.T.	41.3	45.5	37.0	160.7	161.0	125.0
No sender (subject informed)	25.1	35.7	28.2	87.5	95.7	81.7
J.L.	54.2	55.3	44.8	191.4	170.5	149.3
J.L.	56.8	50.9	32.8	240.6	178.0	104.6
R.T.	39.8	24.9	30.3	145.2	74.2	122.1
No sender (subject not informed)	86.0	53.0	52.1	318.1	180.6	202.3
Averages	56.8	49.9	43.1	214.5	169.8	153.5
	-12% -24% ( $P < 0.04$ )			-21% -28% ( $P < 0.03$ )		

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of the seven experimental sets are given in Table 3. The power measures were significantly higher in the 9-11 Hz band in six out of seven average power measures. Note also the reduced effect in the case in which the subject was informed that no sender was present (Run 3). It seems that overall alpha production was reduced for this run in conjunction with the subject's expressed apprehension about conducting the experiment without a sender. This is in contrast to the case (Run 7) in which the subject was not informed.

Siegel's two-tailed *t* approximation to the nonparametric randomisation test<sup>9</sup> was applied to the data from all sets, which included two sessions in which the sender was removed. Average power on trials associated with the occurrence of 16 f.p.s. was significantly less than when there were no flashes ( $t = 2.09$ , d.f. = 118,  $P < 0.04$ ). The second measure, peak power, was also significantly less in the 16 f.p.s. conditions than in the null condition ( $t = 2.16$ , d.f. = 118,  $P < 0.03$ ). The average response in the 6 f.p.s. condition was in the same direction as that associated with 16 f.p.s., but the effect was not statistically significant.

Spectrum analyses of control recordings made from saline with a 12 k $\Omega$  resistance in place of the subject with and without the addition of a 10 Hz, 50  $\mu$ V test signal applied to the saline solution, revealed no indications of flash frequencies, nor perturbations of the 10 Hz signal. These controls suggest that the results were not due to system artefacts. Further tests also gave no evidence of radio frequency energy associated with the stimulus.

Subjects were asked to indicate their conscious assessment for each trial as to which stimulus was generated. They made their guesses known to the experimenter via one-way telegraphic communication. An analysis of these guesses has shown them to be at chance, indicating the absence of any supraliminal cueing, so arousal as evidenced by significant alpha blocking occurred only at the noncognitive level of awareness.

We hypothesise that the protocol described here may prove to be useful as a screening procedure for latent remote perceptual ability in the general population.

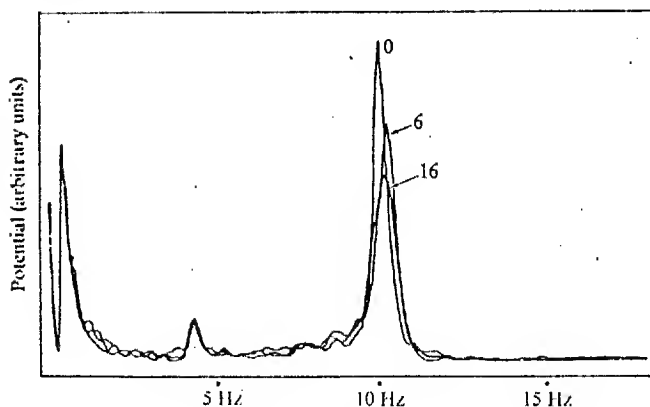


Fig. 3 Occipital EEG spectra, 0-20 Hz, for one subject (H. H.) acting as receiver, showing amplitude changes in the 9-11 Hz band as a function of stroke frequency. Three cases: 0, 6, and 16 f.p.s. (12 trial averages).

### CONCLUSION

From these experiments we conclude that:

- A channel exists whereby information about a remote location can be obtained by means of an as yet unidentified perceptual modality.
- As with all biological systems, the information channel appears to be imperfect, containing noise along with the signal.
- While a quantitative signal-to-noise ratio in the information-theoretical sense cannot as yet be determined, the results of our experiments indicate that the functioning is at the level of useful information transfer.

It may be that remote perceptual ability is widely distributed in the general population, but because the perception is generally below an individual's level of awareness, it is repressed or not noticed. For example, two of our subjects (H. H. and P. P.) had not considered themselves to have unusual perceptual ability before their participation in these experiments.

Our observation of the phenomena leads us to conclude that

experiments in the area of so-called paranormal phenomena can be conducted in a laboratory setting. It is hoped that other laboratories will initiate additional research to attempt to replicate these findings.

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## The stability of a feasible random ecosystem

THE weight of the evidence, and the beliefs of most biologists, seem to support the view<sup>1</sup> that ecosystems tend to be more stable, the larger the number of interacting species they contain. It is puzzling, therefore, that a variety of mathematical models of complex ecosystems appear to give the contrary answer: that complexity makes for instability<sup>2</sup>.

Prominent among such models is the complex system with random interactions, studied in various forms by Gardner and Ashby<sup>3</sup> and May<sup>4</sup>; but their results cannot be applied as they stand to ecological systems. In an ecosystem, the interacting variables are species populations (or species biomass) which cannot take on negative values. Thus, for example, the equilibrium population values must be positive, and it is convenient to denote this necessary property of an ecosystem model by saying that it must be 'feasible'.

The work referred to imposed no such constraint on equilibrium populations in the samples considered. It is of some interest, therefore, to examine the stability of a random model capable of representing ecosystems, by imposing the restriction that the sample be feasible.

I report here the results of computer calculations on such a model. The interaction equations were of the well-known quasi-linear type, in which the rate of fractional increase of a species population is a linear function of the current populations in all *T* species. That is, the number *N<sub>i</sub>* in the *i*th species obeys

$$dN_i/dt = N_i (b_i + \sum_j a_{ij} N_j).$$

All birth rates *b<sub>i</sub>* were taken as 1, and the self-regulating coefficients *a<sub>ii</sub>* as -1. The feasibility requirement was that the



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# Uri Geller and Science

Is Uri Geller the world's most gifted psychic, capable of bending metal without touching it and discovering the contents of closed boxes with incredible accuracy? Or is he the biggest hoaxer of our time, able to convince trained scientists that they saw things which never actually happened? This week, *Nature* publishes the first scientific paper on Geller—a report on tests at the Stanford Research Institute. And in this special issue of *New Scientist*, Dr Joseph Hanlon reports on both our own investigation and the SRI paper



## Geller and New Scientist

Uri Geller was first brought from Israel by a scientist—Dr Andrija Puharich—and has given demonstrations at the Bell Laboratories, New Jersey; the Goddard Space Flight Center, California; Birkbeck College, London; and other research centres. *New Scientist* first reported on Geller two years ago (vol 56, p 360) and more than a year ago (vol 59, p 95) reported on early results from the Stanford Research Institute (SRI). Geller first came to national attention in Britain on 23 November 1973 when he appeared on the Dimpleby Talk-In on BBC television, where he reproduced a drawing in a sealed envelope, bent a fork, and apparently started a dud watch. Two scientists, Professor John Taylor and Dr Lyall Watson, appeared on the programme with him. Geller stressed that he baffled the scientists—a point supported by both Taylor and Watson—and said he was anxious to participate in research with British scientists.

Geller was a sensation on British television, generating far more interest than he had in appearances on national television in the US. And science was an important part of this—if Geller had simply appeared as a magician, he would have attracted much less attention. Yet Geller had indeed baffled the scientists, and it was at least possible that he had powers previously unknown to science.

For this reason, *New Scientist* took the unusual step of setting up its own small research panel and on 26 November invited Geller to participate in experiments. (*New Scientist*, vol 60, p 603). We told Geller that the committee would consist of a member of the Society for Psychical Research (SPR), a research psychologist, the editor and one other representative of *New Scientist*, an independent journalist with a major newspaper, and a professional magician. Geller accepted our invitation quickly, in a letter on 3 December. Although our initial letter to Geller did not actually name the members of the committee, they had already been chosen and were Denys Parsons of the SPR, psychologist Dr Christopher Evans of the National Physical Laboratory (who was responsible for the *New Scientist* parapsychology questionnaire, vol 57, p 209), the editor of *New Scientist* Dr Bernard Dixon (a biologist), Dr Joseph Hanlon (a physicist), international magician David Berglas, and Alan Brien of the *Sunday Times*. We later added a statistician, Professor D. J. Finney of the University of Edinburgh, and a forensic scientist, Dr

the time Geller accepted our offer, he was back in New York. But we met several times with an associate, Yasha Katz, in December and set up a meeting with Geller for 8 February to discuss the experiments. And on "Seeing is believing", a documentary on Thames Television in London on 15 January, Geller declared "when I am doing enough experiments with scientists, this disbelief will drop off."

But only a few days after they arrived back in Britain, Katz reported that Geller had received a bomb threat and cancelled the New Scientist meeting and some, but not all, of Geller's remaining performances. Time passed, and Geller's attitude clearly changed. Katz said the New Scientist tests would have to be delayed, although he assured us that Geller had not dropped out. By then, however, Geller had already backed out of several other sets of tests. And on 3 May 1974, on the New York television show Mid-Day Live on WNEW-TV, his view of scientists had changed to: "the Stanford Research Institute has validated the work I have done with them for a year." Finally, in June Geller told us on the telephone from New York that "I have changed my mind. . . . Right now I don't have the feeling to work with your people."

In preparation for the New Scientist experiments we studied the Geller phenomenon extensively. Dr Joseph Hanlon went to the US for three weeks in January to talk to the SRI researchers and a large number of other people who had dealt with Geller, in an effort to design effective experiments. This report is based primarily on his investigation, but we have not published it until now because it was felt that in fairness to both SRI and Geller, the SRI team should have a chance first to report on their research in a formal journal.

Nature publishes the SRI report this week despite strong misgivings about both the experimental technique and the results, and that journal is certain to be criticised by some scientists who will argue that publication gives Nature's stamp of approval to the results. But publication does not imply agreement, and Nature should indeed be congratulated for exposing the paper to intelligent discussion by the scientific community.

What follows here is New Scientist's attempt, based on its own investigation and on the only scientific evidence available so far, to draw its own conclusions about Uri Geller.

## The New Scientist investigation

Like witnesses to a motor accident, people who have seen Uri bend a spoon or do a drawing by telepathy tell widely differing stories about the same event. And explanations range from the obvious to the impossible, depending on just what the observers thought they saw

### The believers

Heirloom spoons, expensive jewellery, fancy watches, and even a piece of a meteorite—often among their owners' most prized possessions—are now irreparably broken. But their owners point to them with pride, not anger, because they were destroyed by Uri Geller.

This amazing young Israeli is claimed to have the most phenomenal psychic powers the world has ever seen. Even some scientists say he can break spoons by mental powers without touching them, read minds, and make objects appear and disappear. The man who brought him to our attention wrote the book *Uri* (published earlier this year by W. H. Allen), Dr Andrija

Puharich, says Geller has accomplished the task which eluded the alchemists—turned lead to gold—and that he communicates with flying saucers and teleports objects thousands of miles by the power of his mind.

The whole phenomenon is dominated by Geller's own personality. He exudes sincerity and a childlike innocence and desire to please which makes people really want to like and believe in him. This is reinforced by a high failure rate, what seems to be a constant fear that he will not be able to do what he is trying, and genuine pleasure when he does succeed. And he is a consummate showman, having been a male model and a stage performer. On the other hand, even his supporters like Puharich admit that his main goals in life are

## The author comments

Because this is largely a report of my personal investigation of the Geller phenomenon, it is important to make clear my own attitude and biases. I feel strongly that the next interesting breakthrough in science may well come not from expensive research by huge teams in physics and biology, but from research by individuals and small teams into the interaction of people and themselves and their surroundings.

Through biofeedback, we now have control over our bodies of a sort that not so long ago was almost universally agreed to be impossible. Negative ions in the air seem to affect our attitudes. And so on. In the past few years, these areas and others such as parapsychology have become less the province of hopeful amateurs and more the area of trained scientists. At the same time, big science, particularly my own field of high energy physics, has become corporate and unimaginative. Finally, the continuing squeeze on science funding puts the attention more on the scientist who can work on a shoestring rather than the one who cannot get the money to go to still higher energies looking for the quark.

Thus the appearance of Uri Geller and the interest of two scientists at a primarily military research organisation, SRI, sparked my own interest. I was responsible for securing our first (highly favourable) report on the SRI research on Geller more than a year ago. And I was particularly pleased that New Scientist agreed to conduct tests, and that Geller agreed.

I began to collect material relevant to experiments with Uri, and in January I went to the US so that I would have a background picture before we talked to him in February. I spoke with critics and believers, talked with many scientists and other trained observers who had seen Geller work, spoke with the SRI scientists and saw some of their videotapes, and watched many tapes of Uri's television appearances. Most of the people talked to me as a researcher and not a journalist. But what I found greatly surprised me, and now that Uri has withdrawn from the proposed New Scientist investigation, I think it important to present this material to put the SRI report in context.

Joseph Hanlon

fame, money, and women and that he can be childish, petulant, and extremely difficult to work with. It is these latter characteristics that caused ex-astronaut Dr Edgar Mitchell, who was Geller's original funding source and a co-experimenter on Geller at SRI, to fall out with Geller last year. Nevertheless, Mitchell and others who have experienced his whims still believe he is one of the most important psychics of our time.

Another aspect of the Geller personality is his hyperactivity and constant motion. In small groups, either of the press or friends, he flits from one task to another, usually giving up the first time and suddenly returning to it later to find keys and spoons are suddenly bent before anyone realises just what is happening and Geller reads the contents



Uri Geller attempts to bend a journalist's key held by David Dimbleby at a press conference at the BBC Lime Grove (London) studios on 22 November 1973, the day before Geller's appearance on the Dimbleby Talk-In brought him to the attention of the British public

of sealed envelopes which, after he failed to read them before, were left lying around unguarded.

This means that people often disagree on just what they have seen, and no demonstration is totally convincing. The belief of most of Geller's supporters is built on a long series of demonstrations, none of which is watertight, but which together they find give a convincing picture. For most people, there are one or two clinching events, although the clincher for one person may be totally unacceptable to another.

John White, Ed Mitchell's assistant at his Institute of Noetic Sciences, in Palo Alto, California, told me in January of a Geller test at SRI using a bimorph—a brass strip with special coatings which gives a signal in proportion to any bending. The strip was clamped in a vice and Geller was to bend it without touching it. According to White, suddenly one end of the bar began to disappear and reappear on a lower level. Geller had clearly dematerialised part of the bar and rematerialised it elsewhere, White said. But Dr Hal Puthoff, one of the experimenters, found it not particularly convincing and described it somewhat differently. According to Puthoff, Geller had tried to bend the bar unsuccessfully on one day and then returned to try again the next. Early in the test, a piece of the bar suddenly appeared on the table, although the signal from the bar did not change. Puthoff does not take it too seriously because it would be possible for someone to have broken off a piece between tests and it not be

noticed—the equipment was rezeroed in the morning and the film resolution was not good enough to measure the length of the bar. And there is no evidence of it actually disappearing and reappearing—on the film, it is just suddenly there, he said.

Yet Puthoff believes implicitly in Geller. One of the events which convinced him occurred when he was driving down a motorway with Geller in the car. Puthoff said he queried Geller about flying saucers, and Geller said he would prove he got his power from them and promptly stopped the car without touching anything.

### Reporting what you see

Another problem is that even experienced reporters tend to misreport just what has happened. Bryan Silcock, the science correspondent of the Sunday Times, reported on Sunday 25 November last year: "In a taxi on the way to London airport yesterday Uri Geller bent the very tough key to my office desk without even touching it. The key was lying flat in the palm of photographer Bryan Wharton's hand at the time."

But the next Sunday, 2 December, Silcock admitted error on the two most critical points: Geller had handled the key, and it was in fact concealed in Wharton's hands when it was supposed to have bent. Silcock wrote: "I am still not sure I am getting it right. I am being carefully about what happened I am forced to admit to myself that some kind

of trickery would have been possible . . . Geller examined the key, then passed it to . . . Wharton who held it between the palms of his hands. Geller held his hands over Wharton's for a few seconds . . . and sure enough the key turned out to be bent through an angle of about 10 degrees. . . . Geller might have distracted our attention when he first had the key, bent it, and put it into Bryan Wharton's hands already bent."

Journalists are not alone in having this problem—trained scientists do as well. Geller and Puharich gave a demonstration at Bell Laboratories, New Jersey, one of the world's top research centres, on 8 June, 1973. Geller did one of his favourite tests: reproducing a drawing in an envelope. He always stresses that the envelope is sealed and that he has never seen the drawing before. The Bell report, by Charles Davidson, says "two sealed envelopes were brought" and goes on to report Geller's accurate reproduction of the drawing. But the man who actually brought the envelopes, F. Richard Moore, told me in January that in fact the drawings were put into large clasp envelopes which were not sealed. Further, Moore admitted, the drawings were done at short notice, at Geller's request, while Geller supposedly was on the telephone in the next office. Thus, Geller could have used any of several magicians' tricks—including surreptitiously watching the drawings being made, or opening the envelopes and looking at the drawings. But the Bell report implies that neither was possible.

For me, the most dramatic example

of a magician's technique was on the Mike Douglas show on the CBS TV network in the US on 29 October last year, in which the participants and probably millions of viewers were convinced they saw Geller bend a nail on television. I watched a videotape of the show, and this is what I saw: There were several nails on a table in front of Geller. He picked one up with his right hand and gave it to Mike Douglas, who examined it and showed on close-up that it was, indeed, straight. Next, Geller picked up another nail with his left hand and held it by the bottom. With his right hand he took the nail back from Douglas and held it, as well, by the bottom. Then he turned to guest Tony Curtis and asked him to hold the top of both. Still holding both by the bottom, Geller rubbed the nails. Finally he told Curtis to take the nail from his (Geller's) right hand—the one we saw to be straight on close up—and put it down. Still holding the bottom of the left hand nail, Geller continued to stroke, never showing the bottom. Slowly he lowered his finger to expose a slight bend very close to the tip. Despite all of the show of checking to see that a nail was straight, the audience, Curtis, and Douglas never saw the tip of the nail until Geller said it was bent. Thus, we have no evidence that the nail was not already bent, perhaps before the show began, by non-paranormal means.

### Magic sour grapes?

Is the diversion and confusion of observers accidental? Many magicians argue that it is quite intentional, and is precisely what they do all the time when they perform. Magician James Randi, a persistent Geller critic, said he talked to stagehands after the Mike Douglas show and that they told him that Geller specified that they should buy a box of ten-penny nails and that he also asked them to wrap some in a bundle with tape an hour before the show. Geller walks around the studio a lot before the show, Randi said, and it would have been easy for Geller to take his own pre-bent ten-penny nail out of his pocket and put it into the bundle when no one would notice.

But the magic community, with few exceptions, is strongly opposed to Geller, arguing that he is a magician too, but is earning far more money by claiming to be something more. Professional magicians have a vested interest, however, and have earned considerable publicity and money in their own attempts to demonstrate—apparently highly successfully in some cases—that they can do what Geller does. Finally, the magicians note that Geller has failed to perform when large numbers of magicians are watching, or on TV when magicians help set the conditions, and has consistently refused to participate in any scientific experiment (such as New Scientist's) that involves a magician.

Nevertheless, as Geller himself said on Mid-Day Live (WNEW-TV, New York, 3 May, 1974) "everything could be duplicated by magicians, but I doesn't have to mean that I did it the

way they did."

Geller's supporters argue that he is young and simply not yet in full control of his powers, and thus cannot make events happen on command or precisely where he wants. And they point to his high failure rate as being proof of this—if he were a magician, they say, he would always succeed on cue.

Further, they argue that if one believes that the power of the mind can do such things, then the power of other minds should be able to block these events. Thus magicians and others who are working strongly against Geller will always make it impossible for him to perform simply by blocking him. Mitchell is "convinced that the negative thought energies of severe sceptics and critics do interfere with the process you are trying to measure" and thus such people should be banned from the room during scientific tests.

### Why assume the paranormal?

One of the early choices someone studying Geller must make is whether to assume a normal or paranormal hypothesis. Geller is extremely personable and most people, including myself, cannot help liking him. And when he performs, he really makes you want to believe in him. Combined with the rampant confusion that surrounds the Geller tornado wherever he works (which can mean no one ever sees an entire event), it is extremely easy to slip without realising it into the acceptance of paranormal explanations. One of my many surprises was how easily some trained scientists are drawn into acceptance, and then how each event adds to what becomes a strong belief in Geller.

But scientists should be guided, at least in formal experiments, by Occam's Razor: that one should not assume a more complex hypothesis until it is absolutely necessary, simpler explanations having failed.

With Geller, this means that scientists must first convince themselves that events cannot be explained by a combination of magic and psychology before they postulate a paranormal explanation. This need not imply fraud—people communicate far more than they realise by subtle looks, gestures, tone of voice, and so on. In the case of recent reports in Britain of children bending forks and spoons, they may exert more pressure than they realise while stroking the object.

I investigated a large number of Geller events with Occam in mind. I found it extremely difficult to go back and find out just what happened in a Geller event, because of the previously mentioned problem of getting accurate descriptions of the event. But I have been able to gain an approximate picture of what happened in many of them. In a surprising number, the normal explanation was actually more plausible than the paranormal, and the paranormal was accepted only because the witness was strongly committed to Geller. In one case, a person who had seen the event did not even realise that the

normal explanation was contained in their own description.

One example is the case of Geller teleporting Puharich's camera case from New York to Israel, which Puharich quotes in his book *Uri* and which is often cited by Geller supporters. When Puharich explained it to me in January, despite his own belief, a normal explanation became obvious. "I had about 120 kg of equipment that I was taking to Israel so I left all of the excess baggage behind. And one of the things I didn't bring was my camera case for my super 8 camera with which I document a lot of my work. One day Uri and I were at the Dead Sea and I complained to him that one of the dumb things I did was leave this camera case, which is brown, locked in a special closet I have in my house for my equipment. About five hours later he called me up—we'd come back to Tel Aviv and he'd gone to his apartment and I'd gone to my hotel. And he said 'You know you were talking about a camera case—there is something on my bed here—you think it's yours?' So I described it to him and I said 'Look inside, 'cause I've ripped out some of the inside' and sure enough it was my camera case." Puharich then went to Geller's apartment and identified the case as his. "To my knowledge, there is no way it could have gotten there except by teleportation 6000 miles." A sceptic might think it more plausible that Geller simply went to a camera shop, bought a case, and then marked it according to Puharich's own description on the phone.

Another similar description appeared in the 12 June, 1972 issue of the German newspaper *Bild-München*. Reporters took Geller to a cable car which runs up the Chiemgau mountains, and asked him to stop the car. "At noon the uncanny one [Geller] boarded a cable car gondola for the first time in his life, 'I don't think it can be done', he repeated. The gondola was suspended in the air. Uri Geller noticed a control panel on the door which governed the steering mechanism. Suddenly, he cried out, 'I think I can bring it off!'. Then Geller bounded around the car doing various tricks, and periodically changed the direction of the cable car.

### Bending keys by hand?

Some people, however, have seen and accepted a normal rather than paranormal explanation. Bob McAlister, who produces the programme *Wonderama* for WNEW-TV in New York, told about one incident when Geller was there. Geller asked for a key, and McAlister gave him one. "We were in an alcove outside the control room and Geller said 'Let's get out of here'. He held the key up so I could see it, then he turned his back and as he opened a door the key went in front of his body right down by the groin and the other hand came to that position as he was walking through the door. He immediately said 'Do you want to hold the key, that's all right, I'll hold it'—And he was only showing one corner of the key."



He then went into a room with a lot of people, McAlister said, and put the key in someone's hand and "bent" it. But presumably, McAlister commented, he had actually bent it while going out the door.

Thames Television Producer Terry Dixon told me about filming Geller in New York in December 1973. Dixon said that each member of the crew did a drawing and that the drawings were sealed, first in a white envelope, then a brown one, in San Francisco two weeks before the crew arrived in New York to talk to Geller. Each crew member had also signed the envelope. In Geller's flat, Uri was given the dozen sealed envelopes and he handled them one at a time, according to Dixon. At this point both cameraman Mike Fash, and assistant cameraman Peter George, however, noted that Fash's envelope had fallen on the floor and both said, independently, that Geller would do that drawing. Eventually, Geller said that he needed a long rest, and Dixon suggested they move to one of the Thames hotel rooms. Geller agreed and suggested they take only three envelopes, which he picked (drawings by Fash, George, and Dixon). Geller suggested that they be sealed together, but there was no Sello-tape immediately available, so the envelopes were passed to one of Geller's assistants, Melanie Toyofuku, who had them out of sight of the Thames crew for more than 10 minutes, according to Dixon. She had more than enough time to use any of the magician's tricks to see inside (rubbing alcohol on the envelopes to make them transparent, holding them up to a strong light, opening just a corner so that a small light can be put inside, or even opening and resealing the envelopes, among others). At the hotel room, Geller succeeded in drawing a combination of Dixon's drawing (a three-dimensional box) and Fash's (a dice).

## Tightening the conditions

One thing characterises all of these examples: Geller did not do his feat in the simple, immediate way in which it is usually reported. Instead, he succeeded only after unconscious help from a participant or after taking an extra step which could be used by a magician in a similar circumstance. In other words, for whatever reason, Geller worked in such a way as to make the normal explanation seem more likely than the paranormal. Uri's supporters, of course, will say that these are all accidents or coincidences, and that he does not use the opportunities they offer for tricks. To test this theory, it is worth looking at what has happened in those cases where the conditions were made tight enough that Geller could not have resorted to such tricks. Perhaps not surprisingly, he does not perform very well.

One of Geller's standard feats is to have an object put into one of ten light aluminium 35 mm film cans, Geller then selects eight empty cans, one at a time, and finally picks the one with the



object. On the Merv Griffin show on US TV, Geller did the trick successfully, but some people thought they saw Geller jarring the table so that the cans would shake and he could tell which was heaviest. On the Johnny Carson Tonight show on 1 August, 1973, therefore, special precautions were taken and Geller was not permitted to get near enough to the table to jar it or touch the cans. He failed.

On the AM New York show, they went a step further and used heavy film cans that could not be jarred. But Geller went further as well. Magician Felix Greenfield reported that one of the staff rang him shortly before the show was to go on at 7 am to say that when she arrived at 5.50 am Geller was already there, and insisted that he watch while she put the objects in the cans and wrapped tape around them. Greenfield told her that Geller would probably remember how the target can be taped and suggested she retape them. She did and Geller failed.

The Thames TV crew found that Geller could do the film can trick for them when someone was present who knew which can contained the object, but not otherwise, which suggested to them that Geller looked for their reactions.

Bob McAlister of WNEW told of some of the special precautions he took for another Geller event. "Geller said he wanted to try something big like stopping an escalator, and he suggested Bloomingdales [department store]. But our news department suggested Gimble's because they had worked with the public relations department there before. Geller seemed quite upset and disappeared, saying 'I've got to make a 'phone call'. When I got to Gimble's, I talked to a guard who told me that you can throw a switch on any floor to stop an escalator. On my advice they stationed a guard at the switch at each escalator landing. Geller did not stop the escalator."

## Did they see Geller cheat?

At least five people claim to have seen Geller actually cheat. This is a difficult area, because if we cannot trust the reports of observers who say Geller does miracles, why should we give any more credence to those who say he cheated? At least some of the examples, however, seem to have supporting evidence.

Perhaps the strongest case is that of Thames sound recorder Sandy McCrae, who said on television on 15 January

that he saw Geller cheat. But details of the incident were not given on TV, however, and lend strong support to his comment. Film magazines contain ten minutes of film, but a standard sound tape runs 20 minutes. Thus it is normal practice to leave the sound tape running while the film magazines are reloaded. According to McCrae, while the cameramen were diverted reloading film, Geller attempted to divert everyone else's attention by referring them back to a fork he had already broken. But McCrae did not turn to the broken fork, and said he actually saw Geller bend—by hand, not psychic powers—the large spoon. Geller then called attention to the bent spoon and filming immediately resumed.

Support for McCrae's story comes from producer Terry Dixon, who noted that McCrae had been a strong believer in Geller and before this incident was convinced that Geller was genuine. Dixon also noted that Uri and his associates were "obsessively" interested in the equipment, particularly how long it took to reload a film magazine. "No one ever asked questions like that before."

Ray Hyman, a psychology professor at the University of Oregon, was called in to see Geller at SRI by a government agency to whom Russell Targ and Dr Hal Puthoff had applied for funding. One of Uri's demonstrations for Hyman at SRI in December 1972 was to have someone else in the room write down a number on the pad and then he, Geller, would guess it. "As he wrote, Uri made a show of covering his eyes with his hands. From my side, I could see his eyes through his hands. Also, I could easily see, from George's arm motions, that he had written the number 10."

Hyman also told a story, confirmed to me by one of the others present (who requested not to be identified), about a Geller prediction. At 4 pm Geller decided he was "burned out" and decided to go home. About a half hour later he suddenly reappeared, warning one of those present not to fly back to Washington, DC as planned. He said that during lunch he had had a premonition about a plane crashing. But someone decided to call a newspaper, and found that there had indeed already been a plane crash in Washington around lunch time, and the report would have been on the news stands and radio during the half hour Uri was away.

Finally, three people report that they saw Geller cheat when he performed at the New York offices of Time magazine in March 1973. These are perhaps the weakest cases because Time is strongly opposed to Geller. Charles Reynolds, picture editor of Popular Photography, and magician James Randi, both say they saw Geller bend a key in his hand after having attempted to divert everyone's attention by asking for a beer can opener. And Rita Quinn, a researcher in the picture department who was anxious to believe in Geller, saw him peek between gaps in his fingers during a picture drawing test.

When asked on television (Mid-Day Live, 3 May, 1974) about Randi's statement, Geller replied simply "I am sure

## Through a lenscap darkly

One of Uri's more dramatic feats is to apparently project his image onto a film even though the camera has a lenscap taped on. Such pictures have appeared in several places, including the News of the World (2 December, 1973). Geller also projected his image through the lenscap of Yale Joel, the ex-Life photographer who took our cover picture. But he may have made a mistake, and the US magazine Popular Photography (June 1974) was able to suggest a distinctly non-paranormal explanation.

The photo (Figure 1) was taken "through the taped on lenscap" of a Pentax equipped with a 17 mm Takumar extreme wide-angle "fisheye" lens. The photo was taken in Geller's New York apartment. Joel admits that Geller had the camera for several minutes while he (Joel) was out of the room, and so Uri might have been able to untape the lenscap.

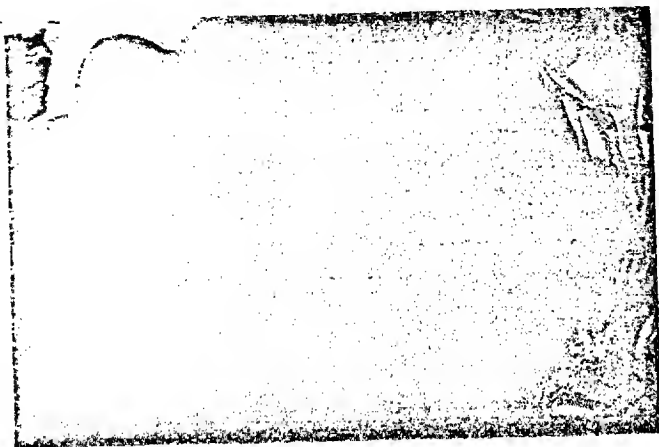


Figure 1 Photo Uri took of himself "through taped-on lenscap" of Yale Joel's Pentax

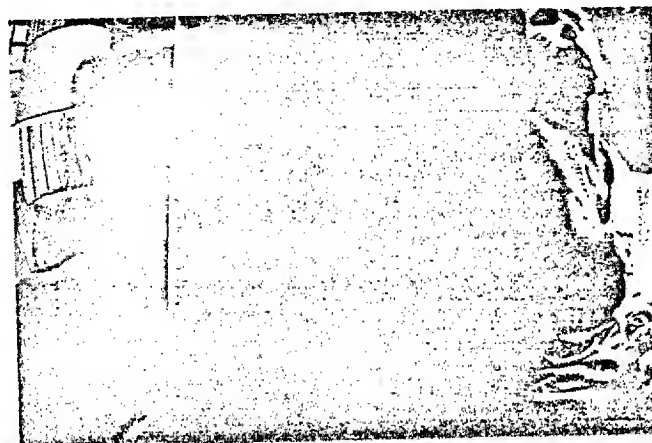


Figure 2 Photo of Seth Joel looks remarkably like Uri's, but...



Figure 3 ... it was taken by holding the lenscap just a bit away from the camera

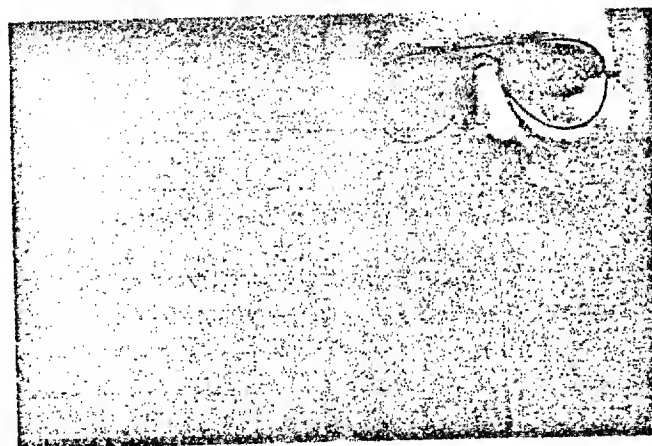


Figure 4 Picture of Seth Joel taken with 50mm lens. Is this what Uri intended?

But it was the sharp circle with the bumps that lead Joel and Popular Photography to their answer. After some experiments, Yale Joel was able to produce a photo of his son Seth (Figure 2) that looks remarkably like Geller's. The sharp circle is the lens cap and the bumps the thumb and finger holding the lenscap. Figure 3 shows how the picture of Seth was taken, although Popular Photography found that one person could do it without help.

Geller apparently knows a lot about cameras, but did he outsmart himself on this one? Popular Photography suggests that what he expected was Figure 4. This is a picture of Seth taken in precisely the same way, only with a 50-mm lens on the Pentax instead of the fisheye. No sharp circle, no

## Transatlantic telepathy

Investigating the Geller phenomenon second-hand is all well and good, but the strongest impressions necessarily come from personal contact with Uri. I have seen Uri work twice, once as part of a transatlantic telepathy experiment conducted by the Sunday Mirror (10 December, 1973) and the other in the Montcalm Hotel, London (19 June, 1974).

In the Mirror test, Geller was in New York, connected to the Mirror office in London by transatlantic telephone. In the Mirror office were Clifford Davis, the Mirror TV editor who arranged the test; Professor Arthur Ellison of City University and chairman of the executive committee of the Society for Psychical Research; Dr Christopher Evans of the New Scientist panel; Ronnie Bedford, Mirror science editor; Patricia O'Flanagan and myself from New Scientist; the Thames TV crew; and about a dozen spectators. Yasha Katz of Geller's staff, and Sidney Young, from the Mirror, were with Geller in New York. The attempt lasted nearly two hours, and covered a variety of tests. Katz listened on the New York end of the telephone and later told New Scientist (during one of his meetings to discuss our experiments) that Geller's biggest success was seeing a photograph of a car.

minutes Geller said "I am getting all the time three pictures". Ellison replied "can you tell us what the three are, just in case one of them matches?" Geller declined and more long silences followed. Finally, at 20 minutes Uri said he could not do it. But Ellison said: "Would you like to tell us anything about the patterns you were getting in your mind when we were all concentrating on the picture?"

Geller replied that he had drawn three different sets of things. First, "three people appeared in my mind with something white underneath". Second, "something long". Ellison immediately replied "that sounds likely, it could be described as something long". Then Geller said it was like an animal—a dog or a horse standing sideways. With no further encouragement at this point, he moved on to the third drawing—which he described as something triangular with a semi-circle coming out of the left side—"a mountain, sort of, with something coming out". Finally, he said he had words in his mind: "pattern, horse, animal, dog, dog, dog".

Although this drew no encouragement from Ellison, he continued to press the dog—asking if there was a photo of a dog somewhere in the room. There wasn't. Only the "something long" had drawn a positive response from Ellison.

Next Geller said that of the three impressions the "biggest one" was the

call that a partial success. Then Young described Geller drawing "a fat sausage with, at the rear, a part that comes down and looks like, say, an elephant's foot, then goes along toward the front and becomes a sort of a breast". Ellison laughed and gave a negative response. Geller then announced that he was finished, and asked Ellison what the photo was.

Ellison said it was a police car, and Geller then claimed to have written down the word "car" even though he had not mentioned it before with the list of words in his mind. Later, he claimed to have written down the word "car" twice.

To me, at least, this was hardly a success. Guided by Ellison, he drew a shape that could have been an animal, a car, a table, a hill, or almost anything. Later in the nearly two-hour telephone call, however, Geller made remarks like "I am happy I got the drawing".

When I asked him afterwards, Ellison answered immediately that Geller had, indeed, gotten the car. He called the test "remarkable" and noted that Geller "didn't say a cup or a tree or a human being". Actually, of course, Geller did mention people and his drawing could have been a cup—it was Young who said it might be a pig or a car. But most important, Ellison seems to have been totally oblivious to the amount of

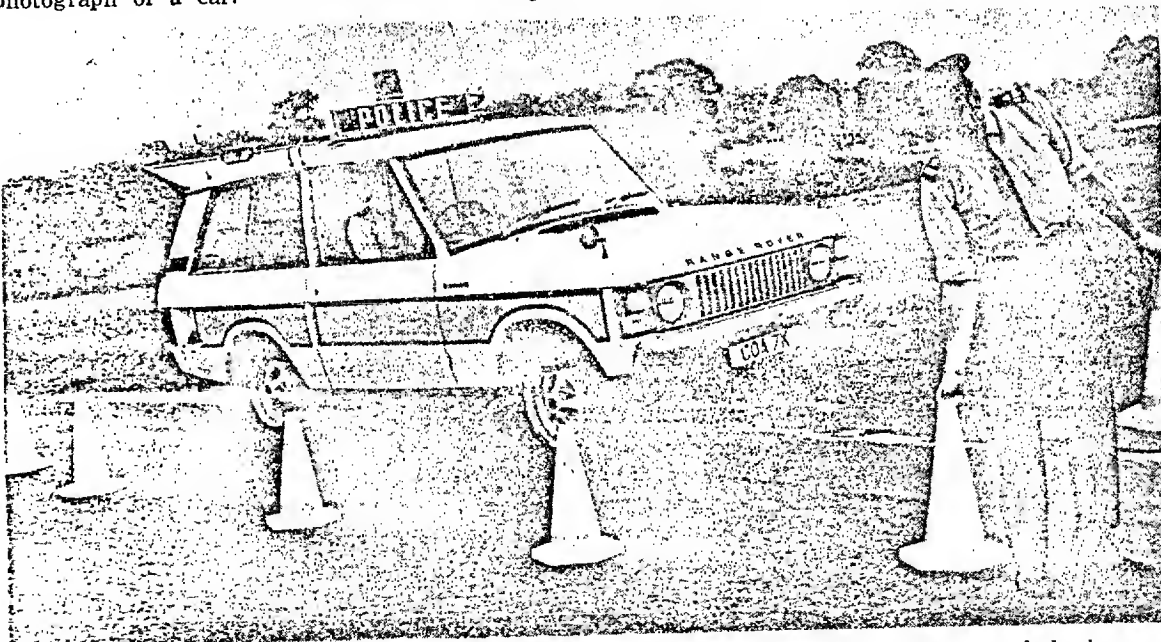


Photo which Uri Geller attempted to see in the Mirror transatlantic telepathy test, 10 December 1973

In fact, the event was not so clear cut. At my request, Patricia O'Flanagan had provided a set of sealed envelopes containing simple photographs which no one but she had seen. When Uri was already on the telephone, she gave me the sealed envelopes and I selected one, which turned out to contain a photo of a police car and a policeman. Professor Ellison was on the London end of the 'phone and concentrated on the photo, attempting to transmit it to Geller. We could all see and hear Ellison and hear Geller.

The photo transmission experiment took 33 minutes—the first half being primarily long silences followed by encouragement from Ellison. At seven

second—an "object that was wide, long, and bright in colour". "Very good," replied Ellison. Geller then went through another series of words—table, flower, telephone—which drew no support from Ellison.

Then, 28 minutes into the test, Geller began drawing and Sidney Young came on the 'phone to describe what he was drawing. It could be "a car or a pig", Young said, which drew a favourable response from Ellison. Then Young said it looked "like a child's wooden toy—the sort of thing you get from Czechoslovakia where it is just a semblance of a car or a pig—not wheels, not legs, not a hood". Ellison responded "very good, we can

help he gave Geller during the entire time. He permitted Geller to offer him three basic shapes from which he chose one, then guided Geller to something that was only vaguely right, and finally accepted Geller's statement that it was, indeed, correct. This is a good example of how Geller is able to draw people into helping him and wanting to believe that he has succeeded, even up to the point of reporting an event that did not happen.

Nothing appeared in the Sunday Mirror about the trial, which surprised me as Geller was hot news at the time. Only later did I find that Geller had accepted that nothing would be published if the test failed.

New Scientist 17 October 1974

## Uri bends my key—and rips his trousers

My second chance to watch Uri work was 19 June when editor Dr Bernard Dixon and I met with Uri in the lobby of the Montcalm Hotel, London, for more than an hour.

We sat in a secluded corner of the lobby and chatted for a long time. Then Uri offered to try some of his skills for us. He tried to reproduce pictures which Dixon and I drew but eventually "passed" (he said he saw nothing clear on his "mental screen") each time. Next he suggested he try bending metal. I gave Uri my housekey, which he worked with unsuccessfully.

Dixon commented afterwards that he was struck by the extent to which Geller stressed his failures—constantly saying he did not think he could do it and telling us stories about his failures on TV and elsewhere. Indeed, he talked far more about failures than successes. The effect, of course, is to make everyone around Geller exceedingly anxious that he should succeed.

Geller suggested we move to the next room—an empty dining room with a few soft chairs near the door. He continued to attempt to bend my key. Noting that it was often easier to bend an object when it was near other metal, he rubbed the key against an upended metal floor ashtray and other metal objects. Even with just the three of us, a high degree of chaos prevailed—at one point I was sent looking for metal and at another looking for a pad. Hotel staff who passed—who by now seemed used to the events—added comments. But still nothing unusual happened.

Finally Uri suggested we move into the corner and sit down on a sofa behind a low coffee table. Bernard Dixon was sent to fetch Geller's jacket. Geller sat down first and I walked around the table and was just sitting down; Bernard was walking across with Geller's jacket. Thus neither of us was watching Geller closely. Suddenly Geller lurched forward, spreading his legs so rapidly that he split his trousers. His hands were down in front of him.

After joking about the ripped trousers, he held the key from the point end, enclosing most of it in his hand, and continued his efforts to make it bend. Geller's hand was slightly arched, however, and I could see clearly that the key was already slightly bent. Suddenly he said it was bending, and slowly moved his hand down the key to expose the bend. The bend was not large and he put the key on the coffee table to show the bend—carefully holding it in a V position so that both ends were off the table and the bend touching. He repeated many times that it was still bending and to prove this he put it back down on the table, now in an L position, with an entire flat side touching so that the other end was higher off the table than it had been the first time. As far as I could see, however, the key was no more bent than when I first saw it in his hand.

I cannot actually say that I saw Uri bend my key by non-paranormal means



But I can offer an explanation that I find more plausible than previously unidentified mental forces. First, it should be noted that keys are surprisingly easy to bend, particularly for a person like Geller with strong hands. Few of us ever try it, however, and we assume it is difficult.

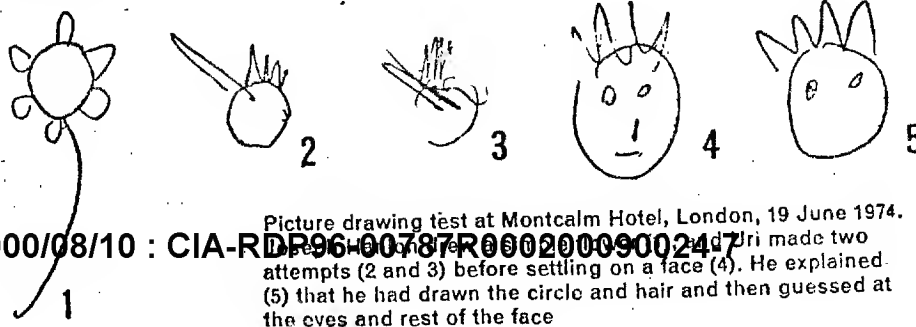
But anyone, including me, can bend a key on the edge of a chair. Sitting in a chair with your legs slightly spread, reach down to the bottom of the chair seat and you will feel part of the chair frame. Holding the head of the key in both hands, put the point on the top of the frame and press down. You will be surprised how easily the key bends. With practice, you can do this with a quick, casual movement in which you pull the chair forward towards a table.

To me, the most plausible hypothesis is that knowing neither Bernard nor I were concentrating at that moment, Uri put the key on the metal rail at the front of the sofa (his hands were in the right place) and then suddenly slid forward. Because the coffee table was too close to the sofa, he had to spread his legs quickly, splitting his trousers.

## Faces and flowers

After the key bend, Uri again tried telepathy. After a couple of unsuccessful attempts—as before he always passed, never showing a final drawing despite attempts on his part—he finally did one drawing. I drew a simple flower (1), Uri made two attempts (2 and 3) which he rejected, and then said that I had drawn a face (4). It is, as he noted, not too far off because it does have a basic circle with lines coming out from it. The final drawing (5) is his explanation—that he drew a circle with bumps and then guessed at the eyes and then the rest of the face.

Uri's relative lack of success, his own explanation of how he did the drawing, and some observations by Bernard Dixon allowed us to piece together afterwards a non-paranormal hypothesis for this effort as well. First, it should be noted that in the early attempts which Uri passed, we had time to think and were drawing relatively unusual figures such as a complex fork and an integral sign. But by the time Geller



Picture drawing test at Montcalm Hotel, London, 19 June 1974. Uri made two attempts (2 and 3) before settling on a face (4). He explained (5) that he had drawn the circle and hair and then guessed at the eyes and rest of the face



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made an attempt, we had little time left with him and I had to think of and draw objects quickly—thus the simple flower.

More important, however, was Bernard's observation that after each drawing, we would carefully hide the drawing, but then Geller would ask us to draw the picture again in our mind. "I found I was making slight head movements, tracing the shape of the drawing. I tried not to, but found it difficult if I was really concentrating hard and tracing the shape as Uri suggested. Watching Joe Hanlon I noted the same effect."

Looking at my drawing and Geller's efforts and explanations, it seems that Bernard's hypothesis holds up well. The head motions for a flower would be a large circle, several short back and forth motions (petals) and one long curving up and down motion (the stem). This is precisely what Uri drew in his first two attempts (2 and 3) exhibiting the fact that it is difficult to tell from head motions precisely where on the circle the other lines should go. Dropping the long up and down motion, and putting the short motions all on the top, seems to suggest

a face with hair. And Uri himself noted that he was sure about the circle and bumps and guessed at the face. Because of the haste with which I drew the picture, he could be sure that it was one of the common ones.

### Not an experiment

My investigation of Geller has been surprising to me in two important ways: first, that every Geller event that I could investigate in detail had a normal explanation that was more probable than the paranormal one; and second, the really strong desire of people to suspend disbelief and accept Geller. On the latter point, I must admit that I, too, was strongly taken with Geller, and that I could not help liking him and being swept up by his enthusiasm—despite the fact that I was looking for tricks.

Many people believe implicitly in Geller—often based on a very few demonstrations of his powers, swept on by their own desire to believe and by the force of Geller's personality. Indeed, some supposedly objective scientists now talk of the "Geller effect" as a fact.

But as Uri himself told me, "a stage

demonstration is not an experiment" because "what I do on the stage is under my conditions". Only controlled scientific tests will tell whether Geller actually has paranormal powers.

But we can use our experience with Geller the performer to help develop and evaluate tests with Geller the experimental subject. And if there is any lesson to be learned, it is that Occam's Razor must be our guide—we must reject all normal explanations before we consider the paranormal ones.

In some cases, normal explanations would not mean that Geller is cheating. It is possible, at least, for someone to reproduce drawings watching a nodding head without realising quite how it is happening. But we must also accept the fact—made all the more difficult by Geller's likeability—that a normal explanation for key bending must imply fraud. And on the evidence of Uri's performances, this possibility must be seriously considered.

So far, there is only one published result of scientific tests with Geller. In the next section, I have tried to look at these experiments in the light of what I have found out about Geller as a performer.

## The Stanford Research Institute investigation

Did SRI "validate" Uri Geller? After months of experiments, in a paper this week in *Nature* SRI reports the only two sets of tests it considers successful—one of telepathy and the other of clairvoyance. Although the authors state that Geller bent many pieces of metal, he never did so under experimental conditions. The paper fails to show that many of the same difficulties of Geller's public performances occurred in the lab, too. Nor does the paper note that by using an ingenious device invented by his mentor Dr Andrija Puharich, Geller could have done both successful tests by non-paranormal means

### The investigators

Stanford Research Institute, in Menlo Park, California, is the site of the only attempt at controlled scientific tests of Uri Geller. SRI was originally established by Stanford University to do military research. After student protests in the 1960s, it was nominally split off from the university. Since then, military funding has decreased and SRI has done increasing amounts of commercial contract research.

The Geller study has been done by Dr Hal Puthoff and Russell Targ. Both are laser physicists with a continuing interest in psychic phenomena who joined SRI primarily to do psychic research (although when funding is short they do return to laser work). Puthoff is 38 years old and joined SRI in 1971. He is the author of a laser textbook, *Fundamentals of Quantum Electronics* (John Wiley & Sons, 1969), and holds patents for a tunable Raman laser and other optical devices.

Targ is 40 years old and joined SRI in 1972 after ten years at Sylvania, where he worked on gas lasers. He invented a tunable plasma oscillator.



Targ has been president of the Parapsychology Research Group of Palo Alto, and invented an "ESP Teaching Machine". In a paper to the IEEE (Institute of Electrical and Electronic Engineers) International Symposium on Telecommunications, he reported evidence that via the machine

and biofeedback techniques, it "may be possible to teach and enhance ESP phenomena" (*Parapsychology Review*, July-August 1972, p 9).

Together, Targ and Puthoff have investigated several subjects in addition to Geller. The funding for the project came from SRI, and they report that

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they had an \$80 000 grant from NASA (National Aeronautics and Space Administration), apparently relating to Targ's ESP teaching machine. But they remain chronically short of money. Funding for the Geller work has come primarily from wealthy individuals—particularly from Judith Skutch, a wealthy Geller supporter in New York, and Dr Edgar Mitchell. Ex-astronaut Mitchell conducted an unauthorised ESP experiment in space in February 1971 and two years ago set up his Institute of Noetic Sciences in Palo Alto to encourage psychic research.

Geller has been to SRI several times over an 18-month period beginning in November 1972. Mitchell and another Geller supporter, Dr Wilbur Franklin of Kent State University, assisted in the first series of tests. The clairvoyance experiment with a die reported in the SRI paper, published this week in Nature (vol 251, p 602), comes from this set of tests. (Copies of the 18 October issue of Nature are available for 45p from Macmillan Journals, 4 Little Essex Street, London WC2.)

## The paper

The SRI paper reports on three tests with Geller, as well as several tests with other subjects. In the first in August 1973, Uri was asked to reproduce target pictures drawn by experimenters at other locations. "At the beginning of the experiment either Geller or the experimenters entered a shielded room so that from that time forward Geller was at all times visually, acoustically, and electrically shielded from personnel and material at the target location. Only following Geller's isolation from the experimenters was a target chosen and drawn, a procedure designed to eliminate pre-experiment cueing. Furthermore, to eliminate the possibility of pre-experiment target forcing, Geller was kept ignorant as to the identity of the person selecting the target and as to the method of target selection," Targ and Puthoff report in the paper.

Altogether, 13 trials were conducted (see Table). For virtually every trial, the conditions were changed—often several conditions were changed at the same time—so that it is difficult to correlate his successes and failures with different conditions.

In four cases (1-4) the targets were chosen by putting an index card into a dictionary to pick a page, then opening it and drawing the first word on the upper left that "could be drawn". Three targets (8-10) were chosen from an already prepared target pool. Three (5-7) were targets "blind to experimenters and subject, prepared independently by SRI scientists outside the experimental group following Geller's isolation"—Geller declined to attempt any of these three. Finally, three targets (11-13) were chosen by computer laboratory personnel and drawn on a cathode ray tube display screen. This is primarily a test of telepathy, as in all cases someone knew what the drawing was. In three cases, however (5, 12,

## Geller picture drawing test at SRI

Trial	Geller location	Target location	Target	Outcome
<b>Picture from dictionary</b>				
1	S1	A	Firecracker	poor
2	S1	A	Grapes	good
3	S1	B	Devil	poor
4	C	S1	Solar system	good
<b>Picture prepared by outsider</b>				
5	C	S1	Rabbit	pass
6	S1	A	Tree	pass
7	S1	A	Envelope	pass
<b>Picture chosen from target pool</b>				
8	S1	D	Camel	good
9	S1	A	Bridge	fair
10	S1	A	Seagull	good
<b>Picture drawn on computer crt</b>				
11	S2	E	Kite	good
12	S2	E	Church	poor
13	S2	E	Arrow through heart	fair

### Locations:

- S1: double walled steel room
- S2: double walled copper screen Faraday cage
- A: adjacent room 4.1 m from S1
- B: office 475 m from S1
- C: room just outside S1
- D: room 6.75 m from S1
- E: computer room 54 m from S2

### Outcomes:

Pass means Geller did not do a drawing. Other evaluations are by the author (JH) based on drawings published with the Nature paper. In general, the drawings seem to be based on a verbal description of the target drawing, rather than either the target word or the target drawing.

**Good:** good pictorial representation of a word or phrase which would describe the entire target picture. Trial 2 is a bunch of 24 grapes (word: grapes) and the Geller drawing precisely fits that description. Trial 4 includes the sun, earth, saturn, two other circles, and the words "solar system". Geller has drawn, in a totally different arrangement, the sun, saturn, several circles, and what appear to be satellites. Both could be described verbally as "solar system" or "sun and planets". Trial 8 is a drawing which could be either a horse or a camel and Geller has drawn a horse. Trial 10 has a large flying bird and a small bird on the ground. Geller's drawing has a large and small bird. The birds do not resemble each other, but both drawings are described well by "large bird with small bird under it". Trial 11 is a kite, which Geller has drawn. The two are about as dissimilar as two line drawings of a kite could be.

**Fair:** pictorial representation of some of the words which would describe the target picture. Trial 13, for example, is an arrow through a heart. Geller has drawn an arrow inside a box. Again, the target and Geller's drawing are dissimilar, despite the fact that they describe the same word "arrow".

**Poor:** pictorial representation of a few words which might be used to describe the target picture. In trial 1, the dictionary word was firecracker, and the drawing is a simple firecracker with a lit fuse. Geller's response appears to be to the word "noisemaker" and includes a drum and words like "noise" and "pow".

### Special notes:

- 5—target in shielded room with no one there to view it
- 6, 7—attemped to make EEG record of Geller, which failed because "he found it difficult to hold adequately still for good EEG records"
- 11—picture displayed on front of cathode ray tube display screen
- 12—picture erased from screen and stored in computer memory
- 13—picture drawn on screen and display intensely turned off so no picture.

## No metal bending

"It has been widely reported that Geller has demonstrated the ability to bend metal by paranormal means. Although metal bending by Geller has been observed in our laboratory, we have not been able to combine such observations with adequately controlled experiments to obtain data sufficient to support the paranormal hypothesis," Targ and Puthoff declare in the paper published this week in *Nature*.

Indeed, the SRI team spent most of its time on metal bending—by far the most spectacular Geller feat—and considerably less time on the perception tests finally published.

In one test which I saw the videotape of, Uri was asked to bend a carefully checked metal bar. He was unsuccessful, and asked for something else. The SRI team provided a special checked spoon. Next he asked for more metal round him for inspiration, and that was supplied. Finally he gave up, but the spoon was set up for the next day and all the other metal, including the original bar, just dumped in the corner of the room.

The next day, he started on the spoon, and again asked for more metal. The original bar was among

the extra collection, and Uri switched quickly back to that. But as only the spoon had been set up and checked, there was no way to see that Uri or someone else had not taken the bar—or any of the other metal—out of the room overnight, bent it, and brought it back in the morning.



Later Uri moved on to still other pieces of metal in the pile. Finally he selected a pair of tweezers which no one had paid attention to because of the concentration on the spoon and bar. Finally, he broke the tweezers, but even Targ considered it all so suspicious that it was not included in the paper. The possibility of sleight of hand—in this and all other metal tests with Uri—was too great even for SRI.

and 13), the picture was not actually being viewed by anyone at the time of the test.

In all ten cases where Uri did a drawing, it had some connection to the target and in some cases Uri's picture was extremely good—for example, when the target drawing was a bunch of 24 grapes, Uri also drew a bunch of 24 grapes.

Perhaps the most striking factor which runs through all 10 pictures, however, is that Uri seems to be drawing neither the target word nor the target drawing. He appears to base his drawing on the words which would be used to describe the target drawing.

## Clairvoyance

The other two tests reported in the SRI paper are of clairvoyance—seeing something in a closed container which no one can know by normal means. Geller succeeded once and failed once.

In the second test reported in the SRI paper, also conducted in August 1973, an SRI artist drew 100 target pictures of everyday objects and other SRI personnel sealed them with black cardboard in envelopes and then sealed the envelopes in other envelopes. Five targets were drawn from the pool each day. Each day Geller attempted drawings of everyday objects, but only rarely came close to the target picture. "The drawings resulting from this experiment do not depart significantly from what would be expected by chance."

In the third test, the SRI team conducted before the other two in

November or December 1972, Uri succeeded spectacularly well. A  $\frac{3}{4}$  in dice was placed in a steel file card box (3 in X 4 in X 5 in). The box was shaken and put on the table, and Uri drew a picture of the uppermost dice face. Then the box was opened. The experiment was performed 10 times, with Uri being correct eight times and passing twice. Unlike the telepathy test, the conditions were not varied—the dice and the box apparently remained the same.

Targ and Puthoff conclude: "A channel exists whereby information about a remote location can be obtained by means of an as yet unidentified perceptual modality."

In these experiments, they write, "we concentrated on what we considered to be our primary responsibility—to resolve under conditions as unambiguous as possible the basic issue of whether a certain class of paranormal perception phenomena exists." They continue that "at all times we took measures to prevent sensory leakage and to prevent deception."

But were Targ and Puthoff vigilant enough, and have they really shown unambiguously that paranormal perception exists?

## Welcome to the circus

A dry scientific paper can never capture the feeling of an experiment. In this case, the Targ-Puthoff paper totally fails to communicate the circus atmosphere that surrounded all of the tests with Geller. As Targ commented

to me, Geller manipulates the experiments to a degree of chaos where he feels comfortable and we feel uncomfortable. Then he bends something."

SRI has filmed or videotaped many Geller tests. The tapes show that Geller constantly bounces up and down, touching everything in sight and running his hands through his hair. In the middle of a test, he frequently jumps up and flits about the room, stopping the test dead. Just as suddenly, he will go back to the test—or to a different one he abandoned earlier. He frequently asks for objects, often from outside the test room, to give him moral support: press clippings from past triumphs, pieces of metal, coins, etc. And he will discuss at length what objects to choose and where to put them. He draws technicians and other observers into the experiment by asking them to help him concentrate, or to get other objects, or to pick a number.

Geller also tries to convince people that things happened differently than they did. In one tape I watched, he tried to say he had not "passed" when he had, in fact, done so. In another, he said that something was bent when it really wasn't. Also, Geller constantly needs reinforcement. He frequently stops and says "I can't do it", thus putting the experimenters in the position of repeatedly telling him that he really can, and thus possibly convincing themselves in the process.

Mitchell commented that "Hal [Puthoff] and Russ [Targ] were so eager to keep Geller around that they worked themselves into a box by meeting his every whim. If he threatened to walk off they would relent and do what he wanted. Of course, they lost control of the situation and it got worse and worse and worse." Mitchell—a strong believer in Geller's abilities who was present for many of the tests—admitted that during the tests they should have demanded "that he curb his impulsiveness, that he should not touch equipment, that he keep his hands properly in view of the camera at all times, and that he cut down his chatter when we were trying to work. It becomes distracting and he uses it, not consciously to distract, but to create a climate of too much noise and muss and bustle."

There are also long periods when he does nothing but stand and concentrate. A single test can take several hours of alternating excitement and boredom. The vigilance of the experimenters is sure to flag during that time.

## Assume he will cheat

The experimenters are conscious of the possibility of dishonesty. "I feel confident that Geller will cheat if given a chance," Targ told me, and he seemed highly sceptical of some of Geller's metal bending attempts. But whether their vigilance against cheating was rigorous enough is open to dispute.

If Geller is cheating, he is probably using sophisticated magic and psychological trickery. But the SRI team has never called in a professional magician. Instead, they relied on two amateur

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magicians, an SRI staff member not connected with the project, and Targ himself, who noted he had "done tricks and been paid for it". But Targ has very poor eyesight, holding things just a few inches from his eyes to see detail, so it is not clear how much he could catch. Targ is also sometimes surprisingly trusting: in one instance during a magnetometer experiment he asked Geller about a black mark on his skin and Geller said it was a scar; Targ accepted without checking although he could not have possibly known if Geller was telling the truth.

One outside observer who is highly critical of the controls applied by Targ and Puthoff comes from a US government funding agency. Targ and Puthoff had applied for money and he was sent to SRI to evaluate the work. Thus, one would expect the SRI team to have put on the best possible performance. A reliable source reports that this official is quite interested in

psychic phenomena, is anxious to believe, and should have been sympathetic to SRI. By his own admission, he watched whatever the SRI team chose to show him. But he concluded that the "controls are sloppy and inadequate". He also remarked that when he suggested tighter controls, "Targ said 'bullshit'".

One of the potential difficulties of parapsychological investigation is the sensitivity of the whole phenomenon, and the inability of even "good" subjects to perform under many seemingly reasonable, controlled conditions. If one accepts the existence of parapsychological abilities, this is not surprising. One would, presumably, be dealing with a talent like musical ability, and it would be not unreasonable to find a skilled violinist, for example, being adversely influenced by playing before a group of people he knew to be hostile critics. Also, because we are dealing with "mental energies", it is not unreason-

able to suppose that a confirmed critic could use his psychological powers to block those of the sensitive.

Thus, the phenomenon will require somewhat different procedures than other forms of research. Some concessions will have to be made to keep the subject happy and comfortable, for example. The real question is: Has SRI gone too far in this direction?

## Screening participants

Typical of the difficulties of this sort of research is that all those who aid the investigators are, to some measure at least, pre-selected for their receptiveness to Geller. "We reached the point that on a particular day, if one of our better but more sceptical investigators was really in a foul mood about the whole thing, we just banned him from the room. And we could get results then, while when he was there we couldn't," according to Mitchell. He

## Uri on film

More than a year ago SRI produced a film of Uri Geller's first set of tests there (in November and December 1972). Although more like a seminar report than a formal paper, it gives some insight into the SRI researchers. (The film is entitled "Experiments with Uri Geller" and can be rented only by "universities and scientific research organisations" from Mitchell's Institute of Noetic Sciences, 575 Middlefield Road, Palo Alto). The narrator is Bonnar Cox, executive director of the SRI Information Science and Engineering Division.

The film shows five tests that the SRI team then considered acceptable (but only one of the five was considered acceptable by the time the paper was submitted to Nature). The first test shown is a telepathy (mind reading) experiment using picture drawing. Fifteen simple drawings were made and sealed in envelopes which were themselves sealed in other envelopes (double sealing). The envelopes were locked in a safe and drawn out at random for each test. The researcher then would open the envelope outside the experimental room, look at the picture, reseal the envelope and enter the experimental room. While he thought of the picture Geller would draw it. Each drawing seemed quite close to the target, but perhaps closer to a verbal description of the target than to the target itself.

Next, the film shows a clairvoyance test in which Geller selects the one can out of 10 that contains an object. The can is a film can. Using a cardboard box

large enough to hold three rows of four such cans, they are placed with the middle two positions left vacant. In each case, a person referred to as a "randomiser" enters the room, arranges the cans, and leaves before Geller enters. Geller instructs the experimenters to remove empty cans one at a time. In the film, he successfully finds a can containing room temperature water and one containing a steel ball.

In a similar test, a dice is placed in a metal box and shaken. Geller then guesses that the top face is a four, which is correct.

There are also two experiments in psychokinesis (PK). In one, a one gramme weight is placed on an electrical balance and covered by an aluminium film can, and then the apparatus covered by a glass cylinder. A chart is then shown with two peaks, which, according to the film, "are apparently due to Geller's efforts. They are single-sided signals, one corresponding to a 1500 mg weight decrease, the other corresponding to an 800 mg weight increase. . . . We have no ready hypothesis on how these signals might have been produced".

Next, Geller is shown actually "influencing" a Bell magnetometer. Moving his hands around the probe, he apparently causes a full scale deflection of 0.3 gauss.

Finally, the film shows two unsatisfactory events. First, Geller is shown deflecting a compass needle. Next, he is seen apparently bending a stainless steel spoon, but this is also

Also shown are two bent rings "measured to require 150 pounds force to bend them" and which "were in Geller's hand at the time they were bent".

The most striking aspect of the film is that the really dramatic events all happen off camera. The first drawing that Geller does on the film is "the most off-target of the drawings he did". Although the film says that the dice experiment was done successfully eight times, the only test shown in the film is one in which Geller finally "passed"; that is, even though he guessed the number he asked that it not be taken into account because he was not confident. In the test with the one gramme weight, Geller is never actually shown deflecting the scale—all the film shows is Geller working unsuccessfully with the balance, and then a trace of another (apparently unfilmed) successful test. During the spoon bending, there is a break in the film and then the spoon never leaves Geller's hand until it is shown to be bent—as usual, it appears to have bent during a break in filming. If, as the team claims, SRI filmed Geller virtually continuously, why did this film have to contain what seemed the weakest examples of each test?

But it may be the bent rings which make the film most suspect. I have already noted the virtual impossibility of telling just when Geller bends something. Therefore, the dogmatic assertion that "these rings were in Geller's hand at the time they were bent", without any film documentation offered, seems more likely to reflect sloppy observation than

explains it by saying that this shows "how important the individual thought process is". The less charitable might suggest that Geller was unwilling to perform before someone who was more watchful than usual.

Another example of this sort of choice came up in a discussion of experiments with Pat Price, also published in the SRI paper. In the test, one of the investigators went to a randomly selected place in the Palo Alto area—a motorway toll booth, a drive-in movie, a marina, etc. Thirty minutes after he started, Price would dictate into a tape recorder a description of where he thought the investigator was. Transcripts of the nine descriptions were given to five judges who were asked to correlate them with personal knowledge of the nine locations but with no knowledge of which descriptions Price said were of which trips. There is a wide diversity, with two judges picking 6 and 7 of Price's descriptions as correct, while two others picked only 3. When asked about the diversity, Targ said that it simply showed that they had to be more careful in picking judges because some judges were not good at doing correlations!

### Good observers?

By far the most important component of the validity of the SRI paper is the investigators' abilities as observers. Two incidents suggest that although Targ and Puthoff may be competent laser physicists, they are less successful in this radically different area. In particular, their desire to believe may cloud their discrimination.

Perhaps the most telling event is Hal Puthoff taking Ingo Swann—an experimental subject not described in the Nature paper—to the quark detector at Stanford University early in 1973. The quark detector is a highly sensitive magnetometer which works by looking at the decay of a magnetic field. This is shown on a chart recorder by a periodic function. Puthoff and Swann independently told me roughly similar stories: Puthoff took Swann to the quark detector, where Swann described in some detail the inside of the detector, of which he could not possibly have had any knowledge. Then, without going near any of the equipment, for short times he both increased and decreased the period of the signal.

Dr Arthur Hebard, who designed the equipment, and who suggested that Puthoff bring Swann there, tells a somewhat different story. He dismisses the description of the inside of the detector by saying that Swann was "talking in such poetic terms that he could have been describing anything". The description was "doubletalk" and the sort of thing any poetic layman would use to describe any piece of scientific equipment.

On the perturbation of the detector output, Hebard made two interesting comments. First, just that sort of perturbation of the detector output by those who share the helium supply are also using their equipment. Second, the

perturbation could have been made simply by fiddling with the dials on the recorder. Hebard is convinced, however, that Swann did perturb the output without touching the recorder. But as often happens, his version of the story tells more than he realises. He said that there were several people in the room and that they stood talking for about 40 minutes. Swann, he said, stood close to the chart recorder looking at it intently for 20 minutes before anything happened. Hebard is sure that Swann did not touch the recorder, but in a crowded room with people talking, who can concentrate on any single object for 20 minutes and be sure it is not touched? Hebard also added a point that neither Swann nor Puthoff mentioned—they came back the next day with fewer people around and Swann failed to have any effect.

One also has the comment of Ray Hyman—the Oregon University psychology professor, magician, and confirmed sceptic about psychic phenomena. Hyman observed a day of SRI tests on Geller in November 1972 and concluded that "they don't know how to observe. Targ and Puthoff recounted incidents we just saw in completely the reverse order, making them miracles".

Finally, there are two problems that apply to all scientists, Targ and Puthoff included. First, future funding clearly depends on success—there is no money available to prove that subjects of their choice have no psychic ability. Second, the mystique of the hard-headed scientist objectively searching for truth bears little relationship to reality; in the real world of science most people are trying to prove the truth of a hypothesis to which they are already committed. Thus it is hardly surprising to find that Targ and Puthoff are strongly committed to Geller and seem genuinely to believe in his abilities (although Targ seems more cautious about Geller's metal bending). Targ has worked in the parapsychology area on and off for 15 years. Puthoff has gone through encounter groups and other West Coast fads, and is now a Scientologist (as is Ingo Swann). In an area where observation is difficult anyway, have the SRI investigators taken enough precautions to ensure that their natural desire to see Geller succeed does not cause them to unconsciously make errors or misinterpret the data to Geller's benefit?

### Omitting a success

One test with Geller that is omitted from the paper throws some interesting light both on Geller and the researchers. Whereas the 13 drawings in the telepathy test are described as the "entire set of consecutive experiments", this is not the case with the clairvoyance test which Geller failed—his attempt to draw the contents of sealed envelopes.

The targets were drawn by an SRI artist at the request of a third SRI researcher who worked with Targ and Puthoff for a short time in August 1973. Geller was unable during the three day test to see inside any of the envelopes.

This is, in itself, interesting as he was apparently able to see inside the box containing the die.

But the paper does not report a curious incident which occurred at the end of the third day of the test. After the formal test had been abandoned, it was decided to loosen the precautions and try again with six drawings. This time the drawings were left lying about the room so that it was possible to remove a drawing from the pile without anyone noticing, and Geller was permitted to leave the room, which he did three times. This time, Geller had no trouble with the clairvoyance test, and succeeded in drawing one of the pictures. Commented the third researcher: "I'm convinced he cheated." If he could do this test under loose conditions but not under tight conditions, is this not worth a mention in the paper?

### Looking in Uri's mouth

The final question that must be answered is how the SRI paper stacks up against Occam's Razor—is there a plausible normal method by which Geller could have done his two successful tests at SRI? Plausibility is hard to define in this situation, but it must take into account anything that can be done with the assistance of Dr Andrija Puharich.

As the box on the next page shows, Puharich is a medical electronics expert who developed a radio receiver which can be hidden in a tooth. It must therefore be considered plausible that Uri has a miniature radio receiver concealed on his person. Even if it is not hidden in his teeth, it could easily be hidden in his hair or in a wristwatch which he presses against his chin to hear. The possibilities are limitless, especially if Uri is not carefully searched. Because Uri constantly runs his hands through his hair and across his face, no one would notice him listening to his Dick Tracy wrist radio—nor, because of the direct nerve stimulation, would anyone else hear it.

There are two small pieces of evidence that give some credence to this suggestion. The most obvious is that all of Uri's drawings are representations of words which would describe the target drawing, and thus are consistent with radio communication. The second occurred in January when Puharich was telling me that in any test Uri should be "properly examined" for hidden devices. But then he suddenly added: "But I know Uri will not submit to excessive examination like total body X-radiation". In other words, Uri will not permit the only test for a Puharich implanted radio receiver.

To some measure, SRI has protected against radio transmission by working with shielded rooms for the picture drawing tests. But have they succeeded, or is it possible to penetrate the room to a radio?

To answer this question, I consulted Robert King, a senior lecturer at Imperial College, London. King wrote the specifications for all three shielded rooms in the College's Electrical Engin-



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earing Department. King was dogmatic: "I could get information into any shielded room." The reason, he explained, is that shielded rooms are simply not designed to protect against secretive attempts to get information through.

The SRI paper gives only vague information on the room in which most

of the tests were done (S1 in the Table, p 179)—it says only that it is "a double-walled steel room, locked by means of an inner and outer door". The second room (S2 in the Table, p 179) is a "double-walled, copper-screen Faraday cage" which "provides 120 dB attenuation for plane wave radio frequency radiation over a range of 15 KHz to 1 GHz. For magnetic

fields the attenuation is 68 dB at 15 KHz and decreases to 3 dB at 60 Hz."

King said that this is typical of screening for shielded rooms, and provides the key to getting data inside in this case. Attenuation drops off very rapidly at the very small wavelengths about 1 GHz, he said, so that microwaves of 10 GHz or more provide a good possibility.

## Hearing with a tooth

The dream of spy writers, a radio receiver that can be concealed in a tooth, actually exists and was invented by Andrija Henry Puharich—the man who found Geller in Israel and brought him to the US. Puharich is a wealthy 56-year-old MD who holds 56 patents, primarily in medical electronics. Since 1960 his inventions have related primarily to hearing aids for people with nerve deafness.

But Puharich's hearing aid is a unique device which stimulates certain facial nerves just as the organ of Corti stimulates auditory nerves, and the person can actually hear normally without using his or her ears at all. The facial hearing system will work with nerves on the face and neck, on the tongue, and in the sinuses, Puharich claims. But for cosmetic reasons, the nerves in a living tooth are best.

"The invention comprises an element applied to a viable tooth, for receiving electromagnetic signals at radio frequency, and a transducer element coupled with a receiving element and with live nerve endings of the tooth for converting the electromagnetic signals to electric signals at audio frequency, and imparting the electrical signals to the nerve endings of the tooth for transmission to the brain," according to US Patent 2 995 633 issued 8 August, 1961.

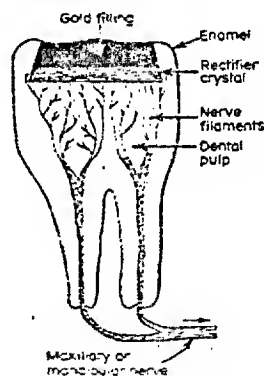


Figure 1 Puharich tooth radio receiver. Signals are received by the gold filling, converted to electric signals in the audio frequency range by the rectifier crystal, and imparted directly to the nerve endings of the live tooth. Drawing from US Patent 2 995 633

Normally, the user would carry a small transmitter in his pocket which would pick up sounds and transmit them to the tooth. But Puharich and co-inventor Joseph Lawrence noted in US Patent 3 267 931, issued 23 August, 1966, that the device "may, of course, be adapted for longer range transmission of radio frequency signals".

Although the device will receive radio signals directly, it works best with an amplifier. In the initial patent, this amplifier is relatively large, concealed in two false teeth next to the viable one with the implant (Figure 2). But by 1964,

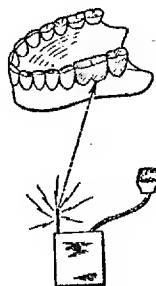


Figure 2 Signals can be transmitted from a radio to a receiver/amplifier hidden in two false teeth, and then passed on to an adjoining viable tooth as in Figure 1. Drawing from US Patent 2 995 663

Puharich had modified the amplifier circuitry (US Patent 3 156 787) to be mounted on the one tooth. The drawing (Figure 3) "is greatly exaggerated in size to facilitate description. . . . The entire assembly . . . advantageously is of wafer-thin construction, so as to be unobtrusively concealed with the cap. . . . It is contemplated that the various components of the system of the invention may be further reduced, to micro-miniature proportions, through the use of so-called 'thin film' circuit fabrication techniques".

The amplification in the 1964 and 1966 patents is provided by a feedback loop within the mouth, using either two different teeth (Figure 4 from the 1966 patent) or the tongue pressed against an exposed terminal on the back of the tooth (left of

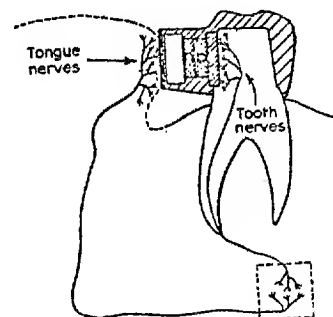


Figure 3 By 1964, Puharich had improved the amplifier so that it could be mounted on the back of the tooth. In this drawing, the amplifier "is greatly exaggerated in size to facilitate description" and would, in fact, be hidden under the tooth cap. The amplifier has a terminal on the left which must be touched with the tongue to complete the circuit. Drawing from US Patent 3 156 787

has the interesting side effect that amplification only works when the tongue is pressed against the tooth, and thus the wearer can listen selectively and be undisturbed by radio signals at other times.

In another version of the device, described in the 1966 patent, an electrode "about the size of a penny which is covered on its operative surface with a thin film of Mylar" could be pressed against the skin in "one of several identifiable areas of the head and neck" to stimulate facial nerves and produce the same effect of hearing. The electrode is connected to a receiver similar to the one mounted in the tooth. The feedback circuit is completed by a connection to any point on the body. For example, a quite small device held in the hand could be pressed against the face.

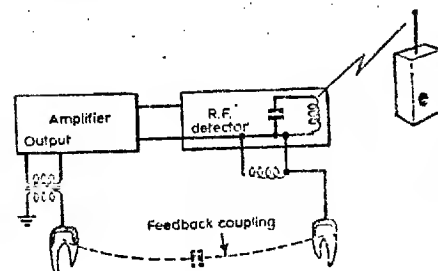


Figure 4 An alternative amplifier system uses two teeth. Based on



## Geller performs at Birkbeck

Uri Geller has worked with one group of scientists in Britain. On 21 and 22 June, 1974, he did a set of tests in the office of Professor John Hasted at Birkbeck College, London University. Also present were Professor David Bohm, Dr Ted Bastin (a friend of Andrija Puharich and a strong Geller supporter, who first introduced Uri to New Scientist in 1972), Brendon O'Regan (another Geller proponent who wrote the first New Scientist report on Geller at SRI), theoretical physicist Dr Jack Sarfatti, authors Arthur Koestler and Arthur C. Clarke, and several other people.

In an unpublished paper, Hasted reports that Geller bent four keys and a 1 cm molybdenum disc 0.32 mm thick, affected a Geiger counter, and deflected a compass needle while at the same time producing a pulse on a magnetometer. Hasted concludes that "these observations are consistent with the hypothesis that Mr Geller could by concentration produce occasional and rather unpredictable pulses of electromotive force".

As usual, they are also consistent with non-paranormal explanations. Indeed, the whole set of tests seems no better controlled than the typical Geller show.

In a telephone interview last month, Bohm told me that "unfortunately there were a lot of people in the room", and that "as far as the key bending is concerned, we had much better conditions in his hotel room [in February 1974] where it was much quieter".

"I can't assure that there were no tricks, and no one there could," Bohm added. "Geller works in a very high state of excitement which communicates to the experimenters, and that makes it hard to keep your mind on what is happening."

According to the Hasted paper, Geller bent four brass Yale keys through angles of between 10° and 40°. "In all cases the bending took a time of the order of minutes

to complete," Hasted noted. With that much time, any good magician could have bent the keys no matter how closely the observers thought they were watching—with the chaos that must have reigned in the office, it should have been trivially easy.

The bent disc was one of ten metal objects. "Mr Geller was not asked specifically to bend this specimen rather than others on the table". As I noted in the box on page 180, SRI observed a similar event and even videotaped it, yet they rejected it because of the possibility of sleight-of-hand.

The Geiger counter was connected to an amplifier and a chart recorder, and "during a total period of about 10 minutes eight pulses of duration of the order of a second were recorded. . . . However, the loudspeaker clicking, which was recorded on magnetic tape, did not always accelerate during the chart recorded pulses, nor did a second Geiger counter record click consistently". To me, this is more consistent with Uri or one of his supporters bumping the chart recorder or fiddling with a knob on the amplifier than with any paranormal event.

As for deflecting the compass needle, the best comment is that made in the SRI film of Geller: "we found later that these types of [compass needle] deflections could be produced by a small piece of metal, so small in fact that they could not be detected by a magnetometer".

Bohm stresses that to perform, Uri must be in the right state of mind. "My attitude is that whatever he requires, we must accept." For example, "considering the sort of person Geller is, you couldn't search him—it would put him off".

Bohm also noted that Geller "tends to get discouraged by complicated set-ups. We had some set-ups that would have given stronger proof, but he was never in the right state of mind".

Microwaves have one important property: they are reflected by metal. Thus, microwaves are often used with waveguides—long metal boxes which will carry the microwaves virtually without loss around tortuous routes. The air conditioning system probably used in SRI buildings would make an especially good waveguide—a transmitter placed anywhere in the air conditioning would transmit to all linked offices. Naturally, air conditioning ducts entering a shielded room have special baffles to screen out radio waves—but these are highly ineffective in the microwave range. On the other hand, microwave transmitting equipment can be miniaturised and draw very little power. A microwave transmitter for this sort of purpose need be no bigger than a cigarette pack. And even though Puharich in his patents talks about his tooth receiver working in the MHz range, it should work just as well in the GHz range. In the configuration where the tongue is part of the amplifier, Geller would even be able to turn it on and off at will, and thus not be affected by possible continuing transmissions.

How would such a radio be used? Perhaps the simplest way would be to use it to bug the room in which the target picture was located. King, Puharich and Puthoff were so anxious to please Uri that they would not have quibbled with a request from Uri to describe the



picture out loud after they drew it—after all, as they say in their paper, the shielded room provided "acoustic isolation".

Another choice would involve Shipi Strang, Uri's inseparable companion. According to Puharich in his book Uri, Geller first met Shipi in 1967 when Uri was serving as a counsellor at a summer camp. Shipi was charged with the task of looking after Uri. Uri met it off well with both Shipi and Shipi's sister Hannah, and Uri and Shipi soon became

constant companions. It was Shipi who first convinced Uri to perform, according to Puharich. And Shipi went with Uri to the US. Although Targ and Puthoff do not mention it at all in their paper, Shipi was constantly under foot during the tests—at least sometimes accompanying the experimenters during actual experiments. Shipi could easily have signalled Uri in code with a transmitter hidden in his pocket, for example. The SRI paper also notes that "the picture was drawn and brought near the shielded room" which suggests that Shipi might have had other chances to see it as well. In the chaos of the computer room for tests 11 to 13, Shipi would hardly have been noticed while the picture was being decided on and drawn. The SRI data shows some support for this sort of hypothesis—when the drawings were under the control of an outsider who would be less likely to accede to Geller's requests and the presence of Shipi, Uri failed (Trials 5, 6, and 7).

Even if this particular technique will not work, Puharich could surely find a simple way. Four other possibilities came to mind in discussions with King: 1) Higher frequency microwaves would pass through the cracks between the steel plates and around the door. Indeed King notes that the space around a metal door would provide a particularly good waveguide. With a transmitter anywhere in the room

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directly outside the shielded room, signals would penetrate in this way.

2) To get electricity into a shielded room (for lights) without any radio transients, the normal procedure is to put a steel plate (usually the room wall) between two sides of a transformer. The 60 Hz magnetic field penetrates, whereas radio fields would not (this is supported by the fact that the copper screened room shows only a 3 dB loss to magnetic fields at 60 Hz). Therefore, King suggests low frequency magnetic induction transmission of data. Frequencies of 5-10 Hz should pass through double steel plates without unacceptable losses. The transmitter coil could be concealed in a briefcase left sitting next to the wall of the shielded room. Geller would have a coil of wire (for an aerial) under his belt or even hidden behind his teeth, and would stand close to the inner wall. During a 30 minutes test, large amounts of information could be transmitted by simple code.

3) If SRI has not properly shielded the mains current supply to the room, it would be possible to send radio signals along the mains (just this system is used for internal radio systems in universities, hospitals, and the like). This could be done with a transmitter smaller than a cigarette pack plugged into any outlet in the building. Geller would simply touch an electric wire inside the cage and his body would act as an aerial for the tooth radio.

4) There is an intercom connecting the inside of the cage with the outside. This could be like a telephone and have a filter to cut out everything above 3 KHz. But if it does not, it too could be used to carry radio signals into the room with the transmitter simply clipped onto the communications wire.

The preceding discussion applies only to the extremely difficult problem of the shielded room. The other successful test—guessing the die—can be much more easily solved by radio. Mr Hubert Caddy of the International Magic Studio, London, tells me that for several years it has been possible to buy a dice for about £50 which radios which face is up! It would not have been too difficult for Uri to have given SRI a normal die that looked like the radio die, let them mark the normal die as they wanted, and then simply mark the radio die in the same way and switch.

Naturally, this all depends on the cooperation of Puharich in perpetrating fraud. Why would he do so? In his book Uri, Puharich reports that extra-terrestrial powers called Hoova speak to him through a voice called Spectra, and have done so for longer than he has known Uri. Uri's power, he says, comes from Hoova. To have any hope of having this report accepted, Puharich needs Uri's success. If Uri came to Puharich and said "Andrija, I have known you for a year now and never once have I cheated you. Now they are asking me to do things I may not always be able to do, but if I fail no one will believe in Hoova. You are a great inventor—give me something to help me just once in a while." In his book Puharich tells of often hearing the voice of Spectra, and

if Uri's request came via Spectra, Puharich would be sure to obey. Thus, Puharich need not be a party to a widespread and continuing fraud to have helped Uri in this way.

I have no proof that Uri did do his drawings in this way. But it fits the data at least as well as the Targ-Puthoff paranormal explanation. By Occam's Razor it is only necessary to show that plausible normal explanations have not been excluded. To be sure, by what might be considered a reverse Occam's Razor, it must also be shown that the route to the normal explanation is not more complex than simply accepting the paranormal. But Puharich takes the plausible virtually into the realm of science fiction.

## Conclusion

The ultimate test of any scientific research, including the SRI work with Uri, is the ability of other scientists to independently reproduce the results. As Uri himself said on a Thames TV documentary on 15 January: "When I am doing enough experiments with scientists, the disbelief will drop off." But there is a real danger this will not happen—that Uri will consider the publication of the SRI paper to be all the scientific validation he needs. Uri has backed out on a written commitment to work with the New Scientist. He backed out on a verbal commitment to work with the Maimonides Medical Centre Division of Parapsychology and Paraphysics in Brooklyn, New York. (The Maimonides team is highly sympa-

thetic to Geller, but it did call in magician James Randi to help set the experimental conditions.) And Mitchell told me that Geller "broke several engagements" at SRI and that he did not seem to want to do any more there even though "we've got funding for it if he will work under conditions acceptable to us." Uri, it seems, will work only with scientists such as those at Birkbeck who seem loth to set any conditions at all.

Thus, it appears that the paper published this week may be the closest to hard scientific evidence we will get, and it must be unusually closely scrutinised. It seems clear that no matter how good they are as laser physicists, Russell Targ and Dr Hal Puthoff are no match for Uri Geller. There is too much evidence that they missed out on important points. And their experiments fail the Occam's Razor test—they did not exclude non-paranormal forms of information transfer that, based on Puharich's background, must be considered highly possible.

I do not question the integrity of the SRI researchers. But science is filled with examples of scientists—often in large numbers—seeing what they want to see rather than what is there. Canals on Mars, polywater, and the supposed double mass peak of the A<sub>1</sub> particle are just three examples. Several magicians have told me that scientists are good audiences because they are so easily fooled. My investigations of the Geller phenomenon support this. The SRI paper simply does not stand up against the mass of circumstantial evidence that Uri Geller is simply a good magician.



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